WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

A Scranton Gillette Publication

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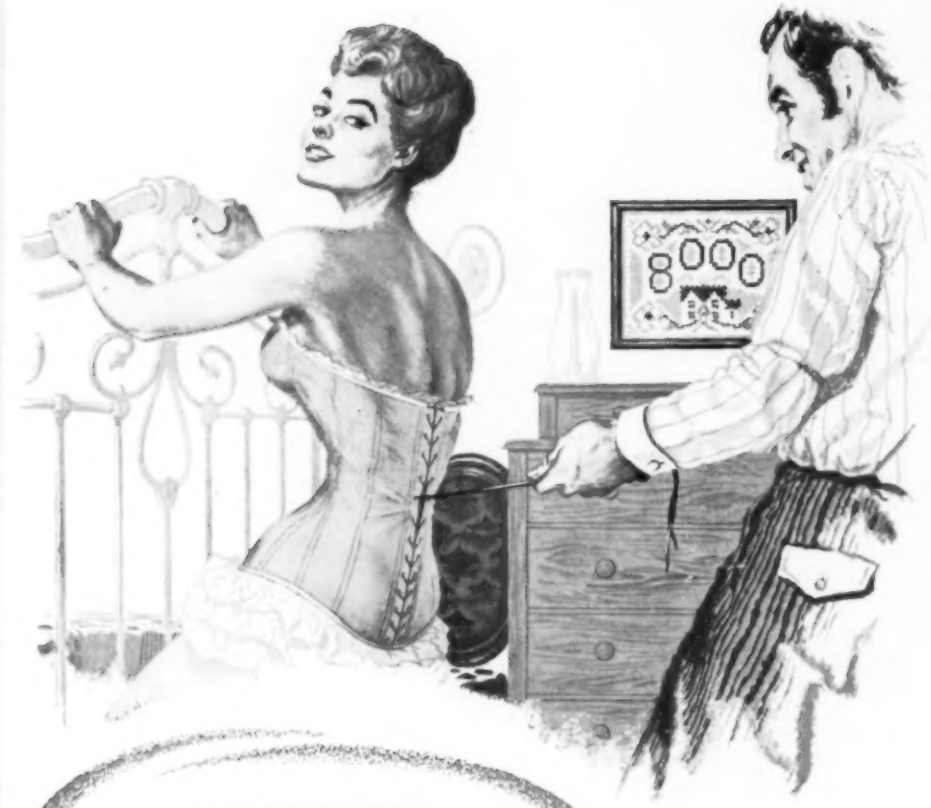
JULY 1957

The New Water Plant of California's Desert City—El Centro

What Modern Flocculation Equipment has Meant to Brantford, Ont.

AWWA's Record Smashing Convention at Atlantic City Highlighted

London's 91 Year Old Sewage Works Readied for Next Century



HIDDEN REINFORCEMENT

Great grandmother used hidden reinforcement to restrain her figure; Lock Joint prestressed pipe design uses much the same principle to restrain the high internal pressures in present day water transmission lines. Lock Joint's hidden reinforcement consists of high tensile wire wrapped under high uniform tension around the core of the pipe.

Can you guess how many miles of such wire were used in the 120,000-foot 66″ Lock Joint Prestressed Concrete Embedded Cylinder Pipeline for Wichita's water supply system? The answer will be found—not too carefully hidden—in the picture above.

Samples of all such high tensile wire used in the production of Lock Joint prestressed pipe not only are certified by mill tests, but also must meet the exacting standards demanded by rigorous tests to which they are subjected in Lock Joint's own laboratory. This is only one of the many quality control measures employed in every phase of the manufacture of Lock Joint Pressure Pipe to assure the customer the finest product obtainable.

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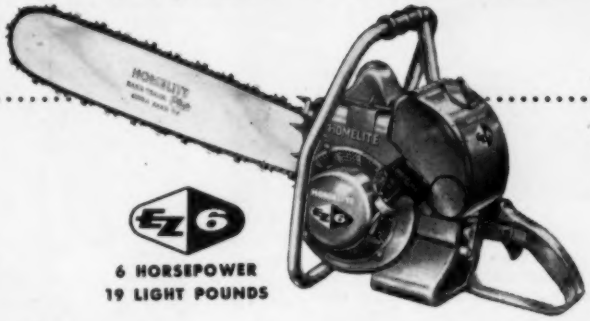
the 6-Horsepower "Power Twins"



The Homelite EZ-6
DIRECT DRIVE CHAIN SAW

Fastest-cutting direct-drive chain saw made, the 6 horsepower of the EZ-6 makes quick work of trees up to 5 feet in diameter. Famous Floating Power and a light 19 pounds make the EZ-6 easiest of all to handle. Ideal for clearing building sites, repairing storm damage, maintaining rights-of-way.

6 HORSEPOWER
19 LIGHT POUNDS

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6 HORSEPOWER
22 LIGHT POUNDS

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HOW TO SELECT WATER-CONDITIONING EQUIPMENT (NO. 2 OF A SERIES)

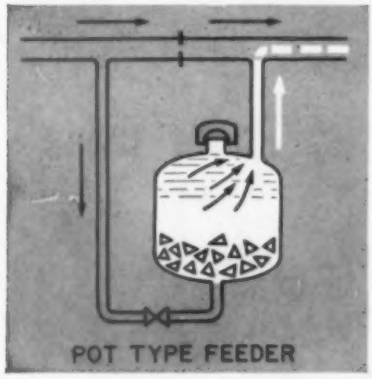
Chemical Feeders

Practically all water-treatment systems include addition of chemicals for one or more purposes: as coagulants to adsorb color, organic matter, oil and turbidity; to raise or lower pH; for lime softening; to inhibit corrosion; to kill bacteria; to adsorb tastes and odors.

The method of feeding the chemicals depends on the kinds used and on the volume, accuracy and proportions required. In general, solution feeders are used for smaller dosages and chemicals which can't be fed dry; dry feeders for large dosages. Here are some of the most-used types of feeders:

Pot type feeders

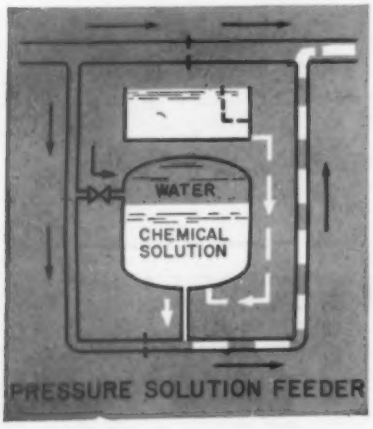
These are used for slow-dissolving chemicals in crystal or lump form (alums, sal soda, etc.) or special briquets. The chemical is placed in the feeding pot where it is dissolved by by-pass water flowing from the high-pressure side of an orifice to the low-pressure side. Since this flow is proportional to the main flow, the amount of chemical fed is proportional. Variations in amount and solubility of the chemical can, however, affect the feed rate.



Pressure solution feeders

These allow use of lower cost chemicals (aluminum sulfate, soda ash, etc.) than pot type feeders and provide more accurate control. The chemical is dissolved in the open tank. When needed, the solution is charged into the bottom of the pressure tank, and the displaced water, being lighter, flows out the top to waste. A sight glass float shows the level of the chemical solution in the pressure tank. When on the line, the feeder feeds from the bottom.

Note that solution feed is into a by-pass circuit instead of directly into the raw water line. This eliminates a long vertical run of undiluted solution which, because of its greater weight over the water in the circuit, could affect proportional feeding accuracy.

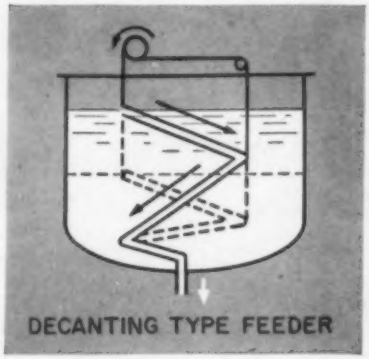


Gravity orifice feeders

A solution of known concentration flows through an adjustable orifice under constant head to provide the desired rate. For intermittent feed, a solenoid valve on the orifice discharge line is operated simultaneously with a raw water pump. Low in cost but limited to constant water flow rates and clear solutions that will not clog the orifice.

Decanting type feeders

This type is known as Permutit Electro-Chemical Feeder. A swing draw-off pipe is lowered at a speed that draws off solution at the desired rate. Feeds practically any type of solution or slurry used for water treatment.



For proportional feeding, a water meter operates a timer that starts the feeder motor which lowers the draw-off pipe for a pre-set period. The timer controlling the lowering rate is easily adjustable allowing wide flexibility and accurate control. Rugged construction. Available with mixing propeller and with cover and dust evacuator.

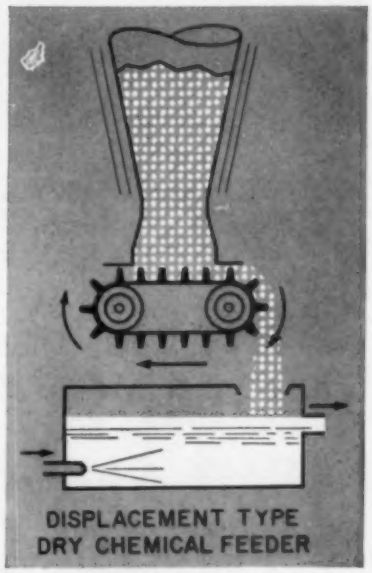
Reciprocating pumps

Pumps with adjustable length of stroke are widely used as feeders . . . generally operated by a meter and timer. Since volumes fed per stroke are uniform, feeding is accurately controlled.

A duplex or double pump feeds one solution to 2 or more points . . . or 2 or more solutions to the same or different points . . . in adjustable proportions.

Dry chemical feeders

A displacement type dry feeder eliminates batch weighing or measuring of dry chemicals and delivers a constant flow of accurately measured amounts of dry chemical (by volume) to a mixing chamber through which water flows at a sufficient rate for good mixing and to prevent settling.



The chemical is discharged from a vibrated hopper onto a moving belt with lugs which "slice" off equal, exact volumes of the dry material. The belt speed is adjustable to deliver from 0 to hundreds of lbs. per hour by simple setting of a stepless speed changer. Adjustable while feeder is running, if required.

The feeder can be designed for constant rate feed or, with a meter and timer, for proportional feeding. Feeds practically any type of non-deliquescent dry powder or granules. Can be equipped with counter to show cumulative amount of chemicals fed.

• • • •

For complete details on feeders or other types of water-conditioning equipment, write: The Permutit Company, Dept. W-7, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

Vol. 104 No. 7

JULY 1957

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CONTENTS

Flocculators of the Walking-Beam Type 279
by Don B. Williams

Report on 77th AWWA Convention 287

New El Centro Water Plant 293
by Joseph F. Golden

What About Air Conditioning? 301
Dear Bill Letter

Meter Maintenance at Utica, N. Y. 302
by John P. Schmidt

The Water Supply of Caesarea 304
by Joseph M. Dennis

Corrosion—II 308
by George E. Symons, Ph.D.

Then and Now—At London County Council Southern Outfall Works 311
by Joseph Rawlinson, C.B.E.

Manhattan College Second Waste Treatment Conference 319

Determination of Flow Characteristics in Sewage Works Plants 325
by John Finch

Meetings Scheduled 102A

New Equipment 107A

Manufacturers' News 114A

Literature and Catalogs 121A

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1. More than 100 motor drives are controlled at the City of Houston Water Works by this Westinghouse control center 2. Heavy-duty Westinghouse motor driving air compressor unit. 3. Motor driving freight elevator at the City of Cincinnati Little Miami Sewage Treatment plant. 4. Low-voltage drawout switchgear in municipal building protects branch circuits and equipment with Westinghouse De-ion® circuit breakers. 5. City of Houston Water Works carries high-voltage power close to load areas with Westinghouse totally-enclosed power centers. 6. Highway lighting — Westinghouse OV-20 mercury vapor lighting units on the New Jersey Turnpike.

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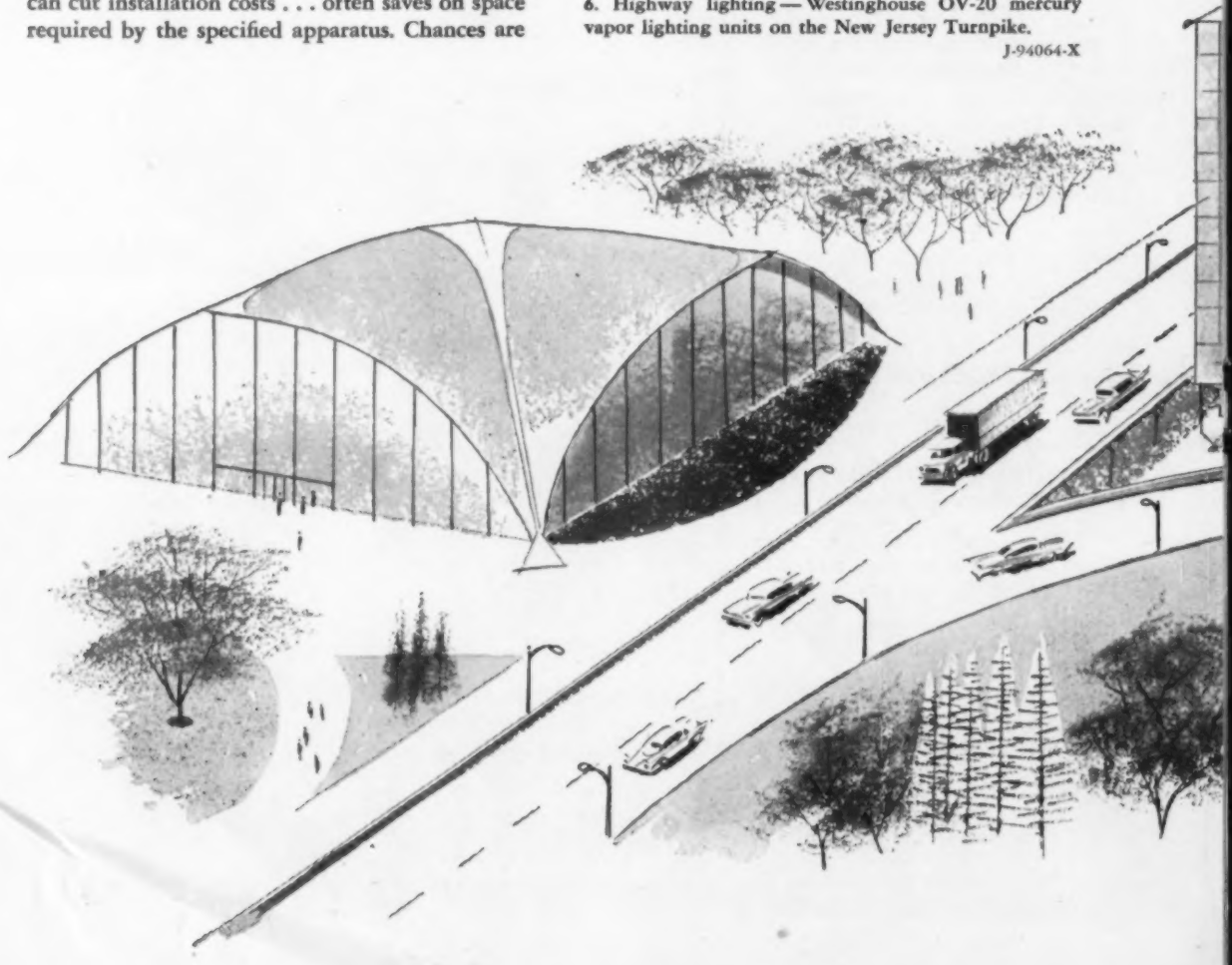
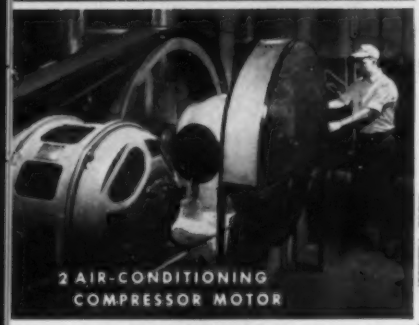


1 WATER SYSTEM CONTROL CENTER

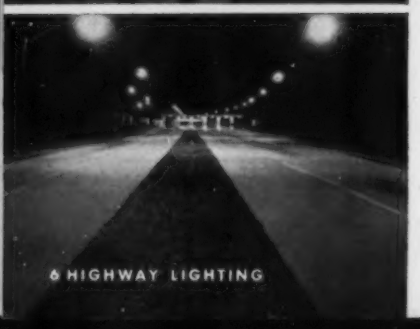


2 AIR-CONDITIONING COMPRESSOR MOTOR

3 MOTOR DRIVE IN SEWAGE PLANT

4 MUNICIPAL BUILDING SWITCHGEAR

5 POWER CENTER IN WATER WORKS



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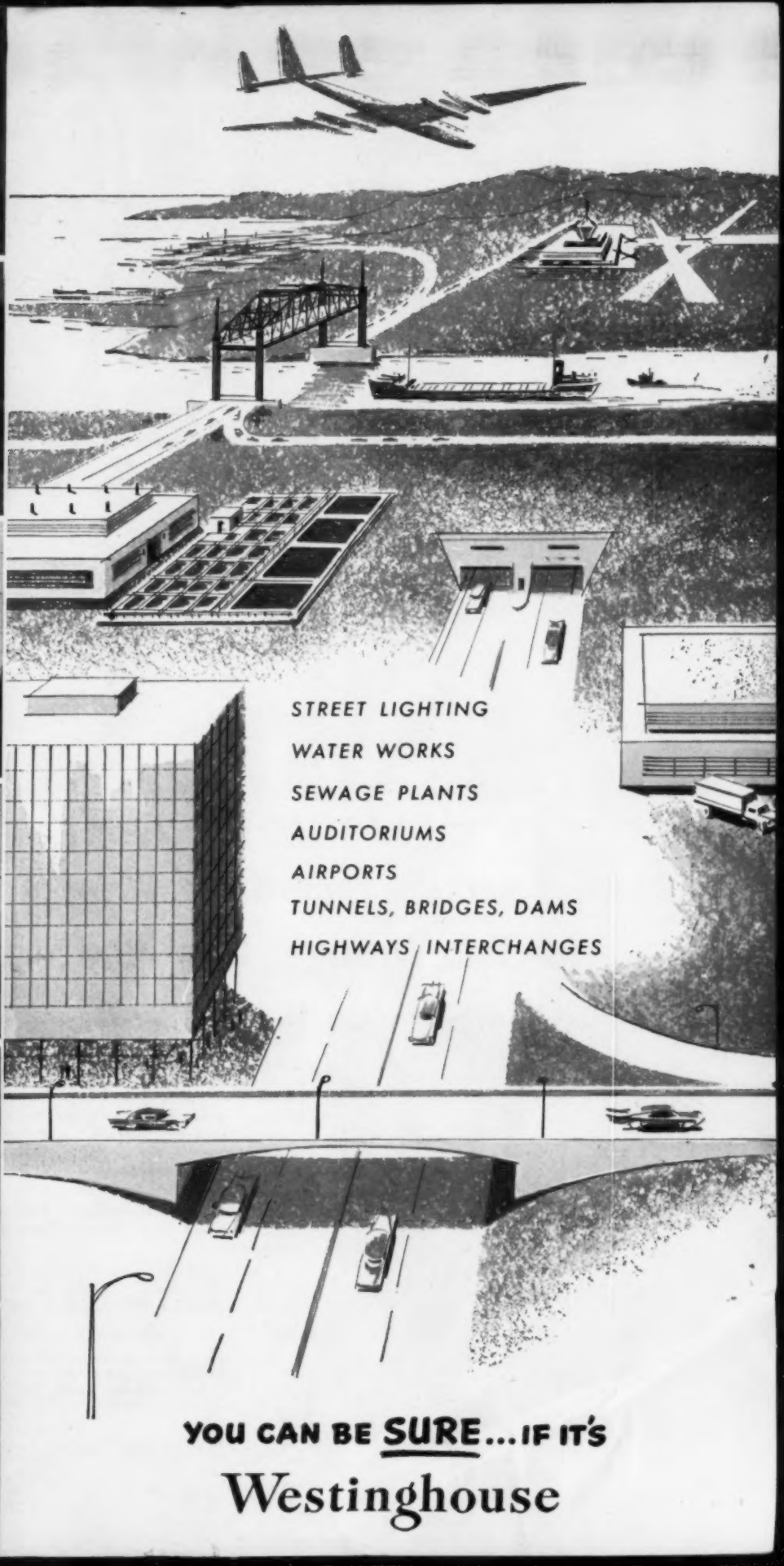

STREET LIGHTING
WATER WORKS
SEWAGE PLANTS
AUDITORIUMS
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TUNNELS, BRIDGES, DAMS
HIGHWAYS, INTERCHANGES

YOU CAN BE SURE... IF IT'S

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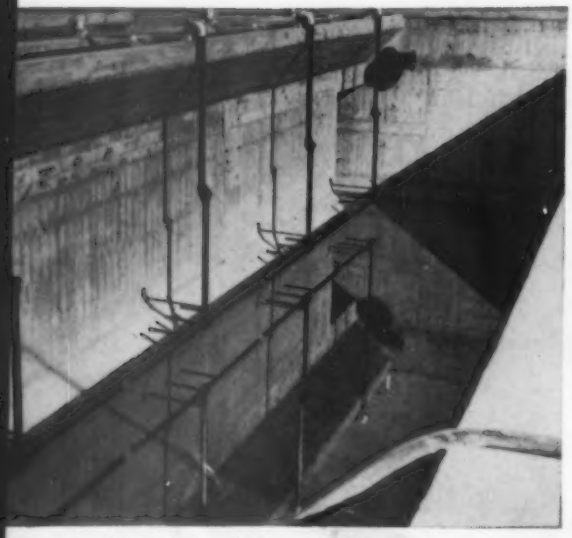
The Columbus, Ohio, Sewage Treatment Plant relies on wrought iron pipe's protective properties in tough, corrosive service

21-year service record provides good reference for this Wrought Iron Pipe railing job



View of wrought iron air diffuser piping in Columbus, Ohio's Sewage Treatment Plant

Wrought iron served so well, so long in corrosive atmosphere surrounding the Columbus, Ohio, Sewage Treatment Plant, that engineers selected this material again for use in the plant's new $2,500,000 addition.

On the job in the original plant since 1935, wrought iron was used for all pipe services two inches and under. In the new addition, 90% of the wrought iron used was for guard railings, 1½ inches in diameter. The remainder of wrought iron tonnage on this installation went into gas lines and miscellaneous piping, including the grease ejector mechanism vault and the air diffuser piping.

We can prove to you how wrought iron outperforms other materials in a variety of applications. Our bulletin—*Wrought Iron for Sewage Treatment and Disposal Installations*—contains the evidence. Write for your copy.

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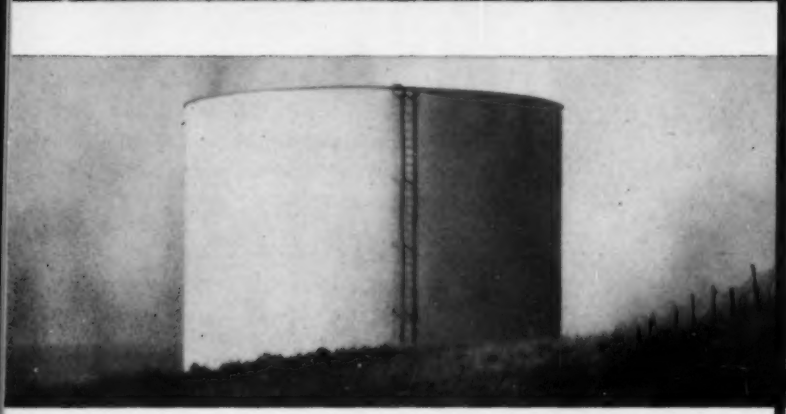

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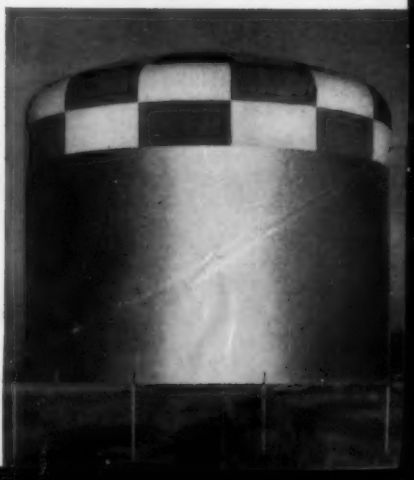

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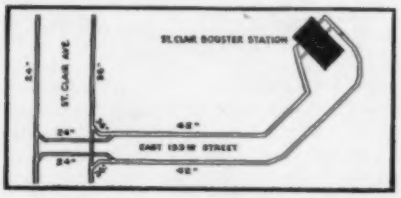
This job for the City of Cleveland used 73 specials and fittings, with the longest run being only 230 feet. It's the toughest kind of a city installation.

However, Henry B. Sherman, subcontractor, reports that the job went smoothly and according to schedule. Prestressed concrete pipe was used, and it turned out to be a good choice. Regular lengths of concrete pipe, short lengths and specials are all designed for the easiest possible installation.

The project ties a new booster station into two distribution lines (one 36″ and one 24″) running along St. Clair Avenue. Within a 100-foot circle, these specials were used: 6 closures, 6 wyes, 6 butterfly valves, 10 elbows, plus flange adapters, short lengths and bevels. Heavy traffic and close 7-inch clearances complicated the work.

Havens and Emerson were consulting engineers on the job. All the pipe and specials were manufactured in the Dayton, Ohio plant of Price Brothers Company. For information on concrete pressure pipe, write Price Brothers at Dayton, Ohio or Hattiesburg, Miss.



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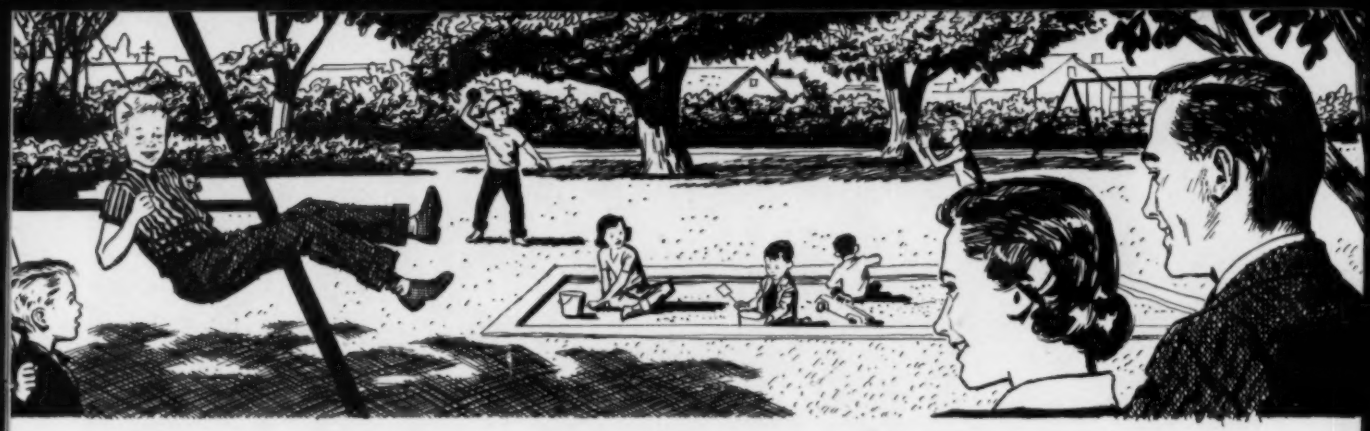

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Badger Water Meters

Water is vital

Badger Meters have conserved it better for over 50 years

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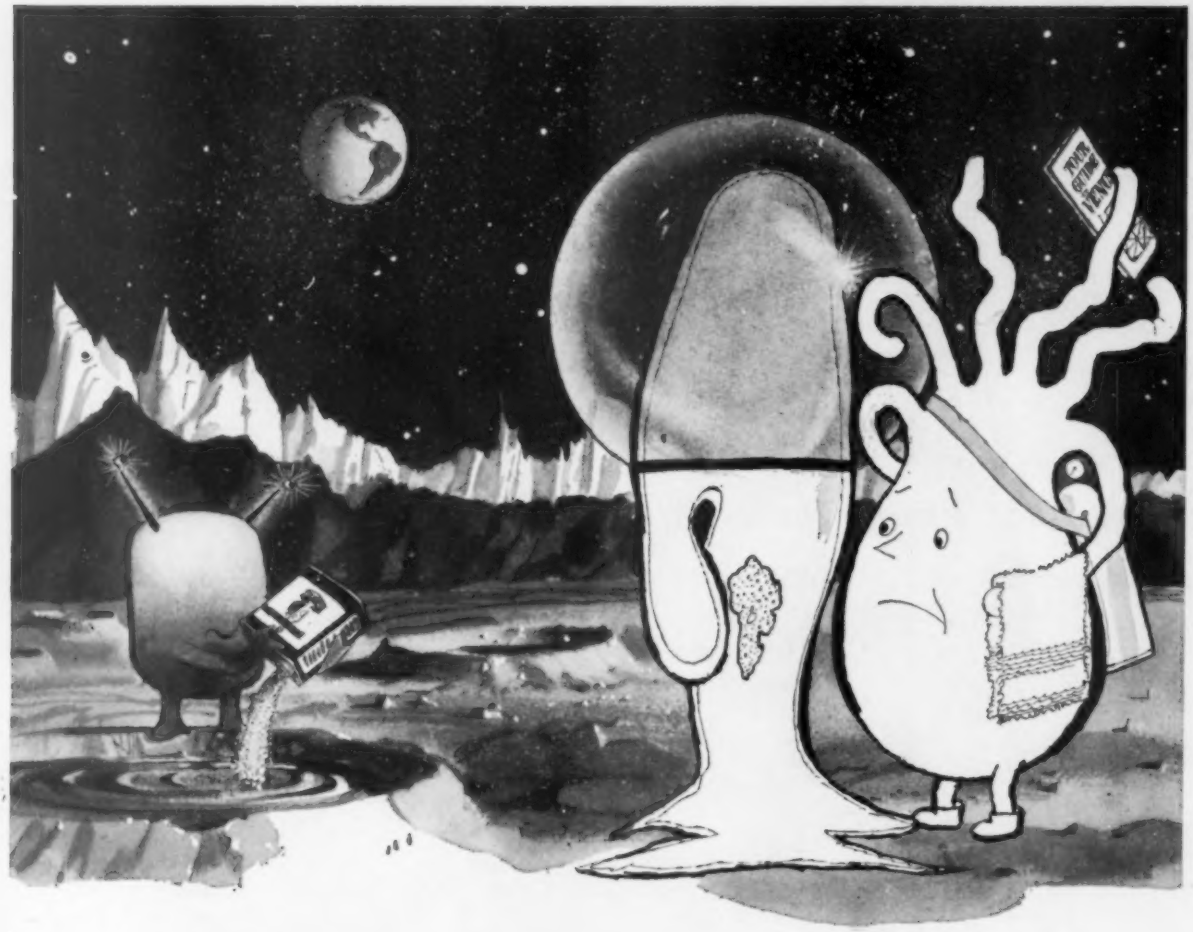

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P.F.T. NEW DEVELOPMENTS IN SEWAGE TREATMENT

P.F.T. prefab aluminum roofing being installed at the Mill Creek Sewage Treatment Plant, Cincinnati, Ohio. Twelve 110-ft. P.F.T. Floating Covers are equipped with this new roofing. Consulting engineers: Havens and Emerson, Cleveland, Ohio.

Now! Lifelong decks for floating covers with new P.F.T. prefab metal roofing!

P.F.T. aluminum roofing is as permanent as the floating cover itself. Unlike conventional job-built decks, there is no wood or composition to rot. P.F.T. aluminum roofing requires little or no maintenance.

This new P.F.T. roofing consists of sturdy prefabricated panel sections; heavily embossed aluminum top sheets, and corrugated supporting bottom sheets. An inch-thick layer of Fiberglas insulation fills the space between. A liner of aluminum foil gives additional protection against heat loss. Helps maintain proper digester temperature control, and keeps heating costs down.

Shipped in easily handled sections, P.F.T. aluminum roofing installs quickly. Each piece is clearly marked for fast, accurate assembly at the plant site. Cut-outs and trim for manholes, sampling wells, hatch framing and other openings are shop fabricated. Aluminum ventilators are provided at the center, and over the sump wells at the rim. A 19"-wide service walkway also is furnished, extending from rim to center dome.

Section of P.F.T. roofing showing (1) aluminum top sheet, (2) inch-thick Fiberglas insulation, (3) aluminum reinforcing channels, (4) corrugated supporting ribs.

P.F.T. prefabricated aluminum roofing is available for both new and existing floating covers. For long range economy, it is the most permanent, best insulated roofing available. For complete details, write today for newly published, illustrated, 12-page Technical Bulletin No. 333.

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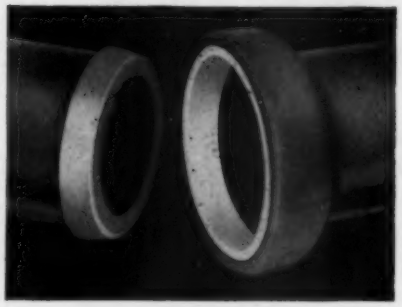
on pipe 4 feet long or over
Available in 4" through 24" diameters



More than 200 major installations have been completed with outstanding results since Amvit Jointed Clay Pipe was introduced in 1955.

Such pioneer cities as Ann Arbor, Michigan, Dayton, Ohio, Camden, New Jersey have installed their second and third Amvit sanitary lines.

A mechanical joint designed for quick, low-cost installation, Amvit* will give you lower cost-in-place. Here's how:

1. QUICK INSTALLATION SAVES LABOR

No other materials such as caulking, joint compound, hot pots, or ladles are needed to make the Amvit joint. The joint is on the pipe delivered to the job ready for use. Just push the pipe together and the joint is complete.

2. IMMEDIATE BACKFILLING

You can backfill as soon as the line is completed. Barricades can be removed and streets opened days sooner.

3. QUICK TESTING

No need to wait days to see if a line has passed test. A look at the completed joint will tell. Thus, engineers can inspect and accept the line allowing the contractor to receive payment quicker.

4. CONTROLS INFILTRATION

Field tests from completed installations show that infiltration can be definitely controlled. Engineers can, thus, reduce infiltration specifications, use smaller diameter pipe and save in material cost.

5. ROOT PROOF

Amvit is a compression joint on the ball and socket principle. The surfaces of both bell and spigot are in uniform compression preventing root penetration.

6. BETTER FLOW, LESS MAINTENANCE

The design of the joint assures that the pipe is self-centered at all times. This gives perfect alignment and self-cleansing. Because the joint is really tight, no foreign matter such as dirt, sand and stones can possibly enter the line.

7. COMPLETE FITTINGS

Amvit is furnished on all standard fittings, as well as pipe. This will permit a uniformly tight line from house wall to treatment plant.

Amvit Jointed Clay Pipe, in sizes 4" through 24" together with all fittings is available for immediate delivery in the Northeast and Central States.

For more information on how Amvit can help cut your sewer project costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

*T. M. Registered. Patents Pending

SINCE 1900

AMERICAN

American Vitrified Products Company

CLEVELAND, OHIO

MANUFACTURERS OF: Clay Pipe, Flue Liners, Clay Liner Plates and Concrete Pipe.

Plants Across the Nation . . . Brazil, Indiana · Chicago, Illinois · Cleveland, Ohio · Crawfordsville, Indiana · Detroit, Michigan · East Liverpool, Ohio · Fenton, Michigan · Grand Ledge, Michigan · Lisbon, Ohio · Los Angeles, California · Milwaukee, Wisconsin · South Bend, Indiana · Uhrichsville, Ohio

You can't buy a better
Water Meter than

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HERSEY MANUFACTURING COMPANY

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BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
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Digging up city streets to replace worn-out mains is always a costly operation . . . and one that causes great public inconvenience.

Installation of permanent CAST IRON PIPE is the best insurance any community can buy against recurrent and costly outlays for pipe replacement and repairs. **No non-metallic substitute ever matched the record of CAST IRON PIPE for longevity, durability, dependability, low maintenance cost and long run economy.**

These 68 Cities in the U. S. A. and Canada are still using CAST IRON Water or Gas Mains laid more than a century ago:

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BOSTON, *Massachusetts*
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BRIDGEPORT, *Connecticut*
BUFFALO, *New York*
CHARLESTON, *South Carolina*
CHICAGO, *Illinois*
CINCINNATI, *Ohio*
COLUMBIA, *Pennsylvania*
DETROIT, *Michigan*
ELIZABETH, *New Jersey*
EVANSVILLE, *Indiana*
FALL RIVER, *Massachusetts*
FREDERICK, *Maryland*
FREDERICKSBURG, *Virginia*
HALIFAX, *Nova Scotia*
HARTFORD, *Connecticut*
HUNTSVILLE, *Alabama*
INDIANAPOLIS, *Indiana*
KNOXVILLE, *Tennessee*
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LOUISVILLE, *Kentucky*
LYNCHBURG, *Virginia*
MADISON, *Indiana*
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MINERSVILLE, *Pennsylvania*
MOBILE, *Alabama*
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NEW HAVEN, *Connecticut*
NEW ORLEANS, *Louisiana*
NEWARK, *New Jersey*
NEW YORK, *New York*
NORRISTOWN, *Pennsylvania*
PAINESVILLE, *Ohio*
PEORIA, *Illinois*
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PITTSBURGH, *Pennsylvania*
PLYMOUTH, *Massachusetts*
POTTSVILLE, *Pennsylvania*
PROVIDENCE, *Rhode Island*
QUEBEC, *Canada*
READING, *Pennsylvania*
RICHMOND, *Virginia*
ROCHESTER, *New York*
SACRAMENTO, *California*
ST. JOHN, *New Brunswick*
ST. LOUIS, *Missouri*
SALEM, *Massachusetts*
SAVANNAH, *Georgia*
SPRINGFIELD, *Illinois*
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TROY, *New York*
UTICA, *New York*
WHEELING, *West Virginia*
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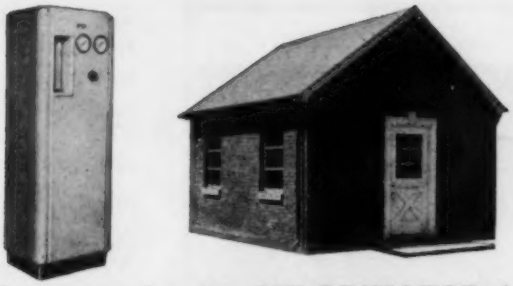
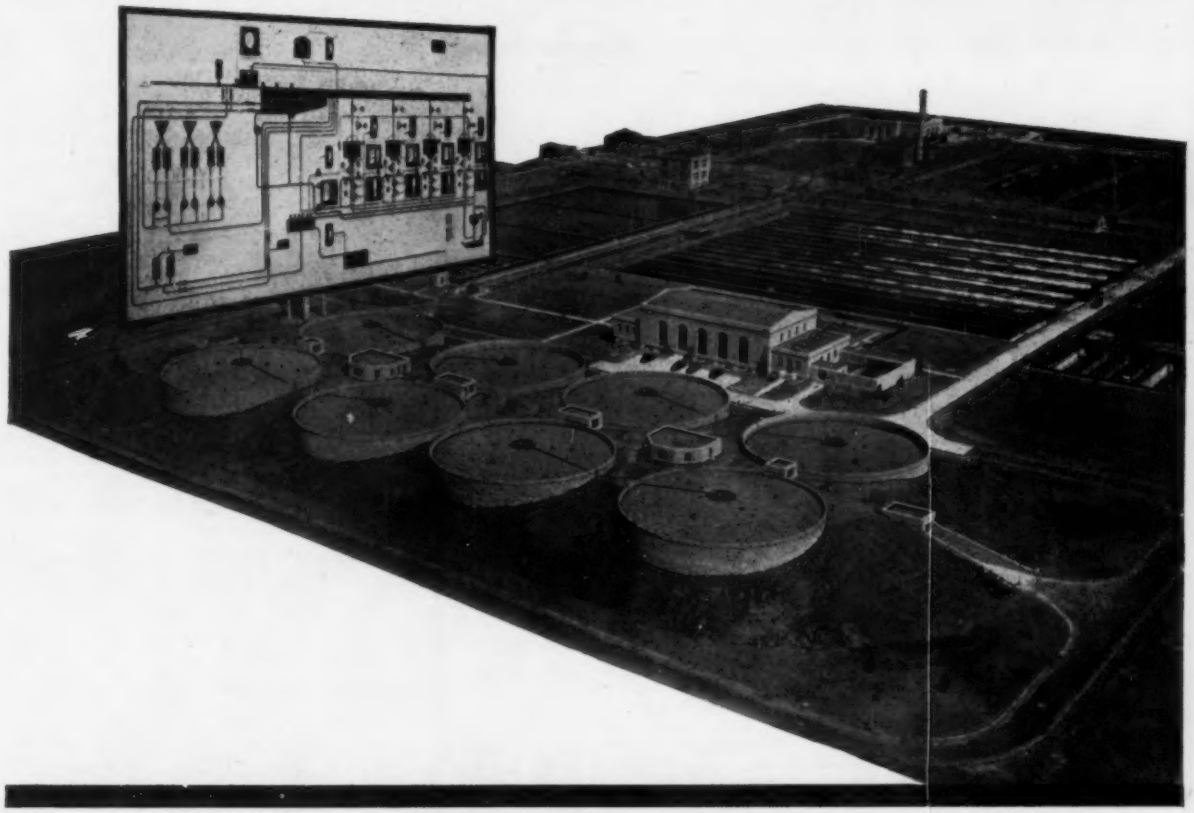
Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.

WOODWARD IRON COMPANY
Since 1882
WOODWARD, ALABAMA



from a simple CHLORINATOR in a pumping station

to a complete CONTROL SYSTEM in a multi-million dollar plant



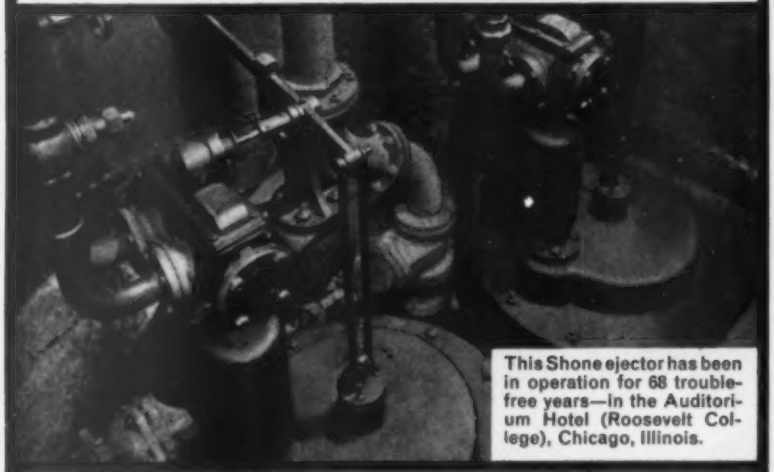
for water, waste, and sewage treatment

. . . consult Fischer & Porter first! Contact the Fischer & Porter field engineer serving you . . . or write Fischer & Porter Company, 177 Fischer Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 June St., Toronto, Ontario.

FISCHER & PORTER CO.

Complete Process Instrumentation

for pumping domestic and industrial wastes...



This Shone ejector has been in operation for 68 trouble-free years—in the Auditorium Hotel (Roosevelt College), Chicago, Illinois.

YEOMANS pneumatic ejectors cut service costs because

THERE'S NOTHING TO WEAR OUT

- NO ROTATING PUMP PARTS
- NO AIRTIGHT FLOATS
- NO HIGH-SPEED SHAFTS OR BEARINGS

With Yeomans pneumatic ejectors, maintenance costs are 50% to 75% lower than with the best centrifugal pumps. The secret? Simplicity of design. Yeomans pneumatic ejectors are built to give you decades of trouble-free service—in fact, they will outlast your system.

They're recommended for low gallonages. Even the smallest Yeomans ejector will pass solids up to the size of the inlet and discharge valves . . . minimum of four inches. No danger of clogging.

They're safer, and completely sanitary. Fully enclosed, hermetically sealed. Dangerous hydrogen sulphide gas is never released.

Yeomans manufactures both centrifugal pumps and pneumatic ejectors, but recommends the ejector where extreme dependability is required. Among the seven models and more than 100 sizes there is a pneumatic ejector that will exactly fill your needs.

Manufacturers of: pumps for drainage • sewage • condensation return • water supply and circulation • equipment for treatment of domestic and industrial wastes.

YEOMANS

YEOMANS, 1999-9 N. Ruby Street, Melrose Park, Illinois

Please send me literature on the pneumatic ejectors I have checked.

The Shone ☐

The Packex ☐

The Expelsor ☐

name_____

company_____

street_____

city_____ zone____ state_____

Shone Ejectors Operated By Remote Compressed Air Source at Palm Beach

The problem of underground equipment maintenance was skillfully handled by the engineers of the new sewerage system at Palm Beach, Florida. The electrical equipment is housed in centrally located buildings where it is easy to service. The underground sewage lift stations contain only extremely rugged mechanical equipment which requires virtually no maintenance.

The system was engineered by Norman C. Schmid & Associates of Palm Beach, and Clifford & Associates of Miami Springs. Malcolm Pirnie & Associates of New York City acted as consultants to the engineers.

Two air compressor stations at ground level furnish power for the 14 sewage lift stations at Palm Beach. Compressed air is piped to the Shone Pneumatic Ejectors which are located in the underground lift stations. The Pneumatic Ejectors operate on a mechanical principle which is practically foolproof. Need for maintenance on the valves is very rare. The Shone will even continue to operate perfectly should the entire station be submerged.

The Shone Pneumatic Ejector is generally recognized as the most trouble-free type of pumping known. Several, which are in operation today, have been giving good service with a minimum of maintenance for over 60 years. One famous Shone was shut into solitary confinement for 20 years. By error it was bricked up and forgotten when the building was remodeled. During the entire period it continued to give faithful service without any maintenance whatsoever.

(*Advertisement*)

Free Periodical on Pumping and Sewage Treatment

The Yeomans Guard is a useful publication concerned with pumping materials and the effective treatment of wastes—both domestic and industrial. It is available to you. A copy of the current issue will be sent to you promptly upon request. Contact your local Yeomans representative, listed in the Yellow Pages of your telephone book under "Pumps"—or write Yeomans direct.

(*Advertisement*)

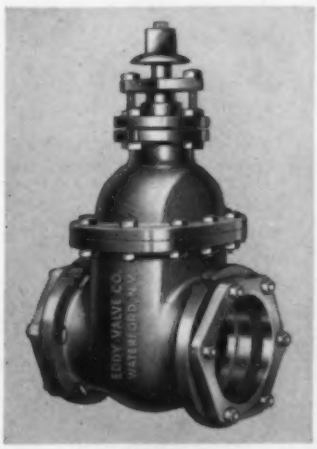
OUT THEY GO!

and IN go EDDY HYDRANTS

Many of the 650 fire hydrants in Maywood, Illinois (pop. 30,000), have been in service 40 years or longer. Some were no longer being manufactured, and repair parts were unavailable. In a decision to modernize its hydrants, Maywood decided to standardize on Eddy hydrants in 1954—to simplify servicing, cut maintenance costs, reduce parts inventory, and assure service for the future.

Eddy hydrants had proved highly satisfactory in Maywood's 50-mile system, and repair parts have always been available. Under the aggressive direction of public works director Bazel E. Crowe, above left, the replacement program, has proceeded at a fast, economical rate, with more than 170 hydrants replaced in 1956 alone.

it's the safest, most economical course!



Maywood feels that it cannot risk hydrant failure, nor afford the sky-high cost of handmaking individual repair parts for obsolete, "orphan" fire hydrants. Can you?

Based on the experience of this and other alert communities, your city or village might do well to take stock of its hydrant situation. If so, an EDDY man will be very glad to give facts and figures you will find most helpful in making a wise decision. Won't you invite him to see you . . . soon?

AWWA EDDY BRONZE-MOUNTED HYDRANTS

EDDY Bronze-Mounted HYDRANTS open smoothly with the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held in place below hydrant valve means that there is no water loss due to a bent stem.

EDDY AWWA (UNDERGROUND) VALVES

Everything in AWWA valves for underground use in your waterworks system is quickly available from Eddy—gate valves; cutting-in valves and sleeves; tapping valves and sleeves. And, remember, Eddy's more than 100 years' dependable operation is your assurance of service far into the future.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
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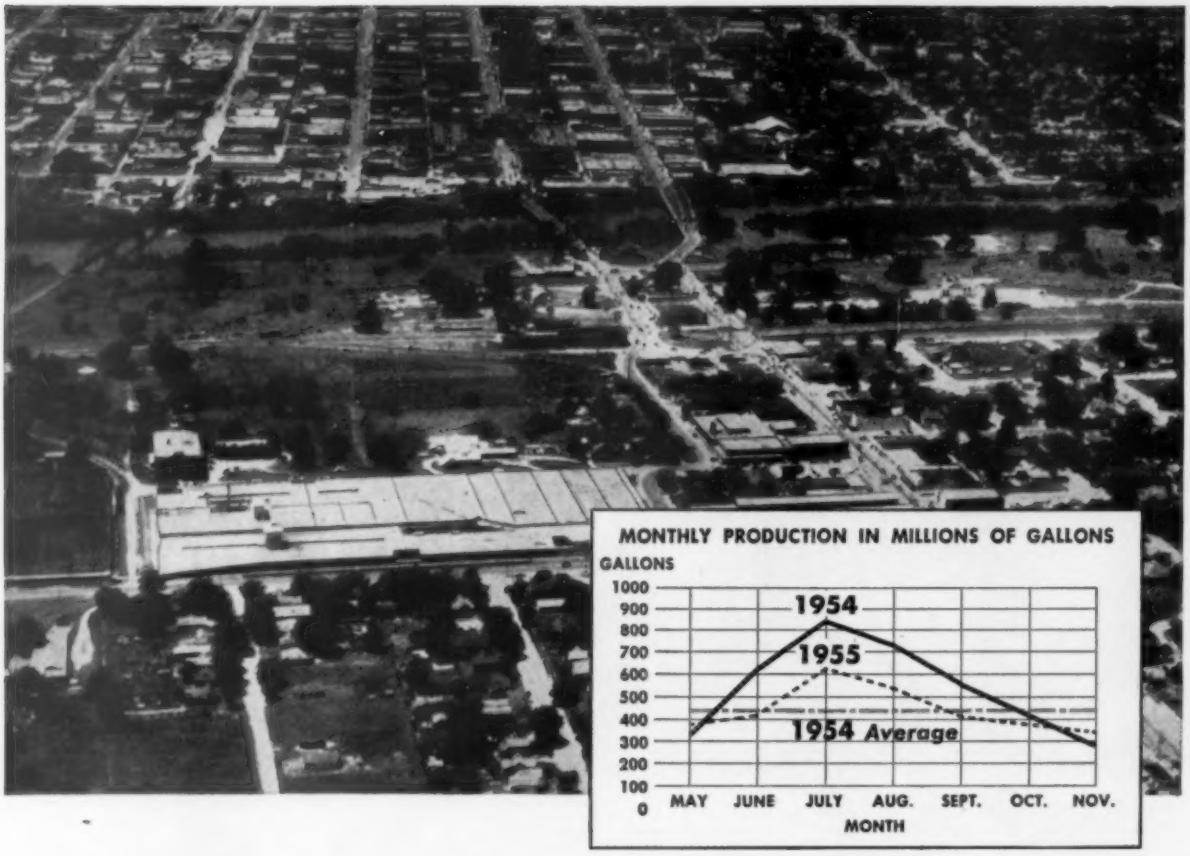


ALOXITE® underdrains handle double load without difficulty in Waco, Texas

Peak loads during dry spells really tax Waco's water system. At these times the filters handle up to 4 GPM per sq. ft.

In July, 1954, for instance, water consumption jumped from the year's average of 448 MG to 842 MG per month. Despite this 87% increase in demand there were no operating difficulties.

Much credit for being able to meet such abnormal requirements is given to the ALOXITE® aluminum oxide porous underdrains. These were installed in new filters in 1951.

Since then, several related events have occurred. Population has grown from 84,000 to 110,000. Water consumption has reached 14.7 MGD from 10.0 MGD. And mudballs and upset beds are but a memory for the plant operators. Uniform, ample backwashing is now an established and vital phase of operation.

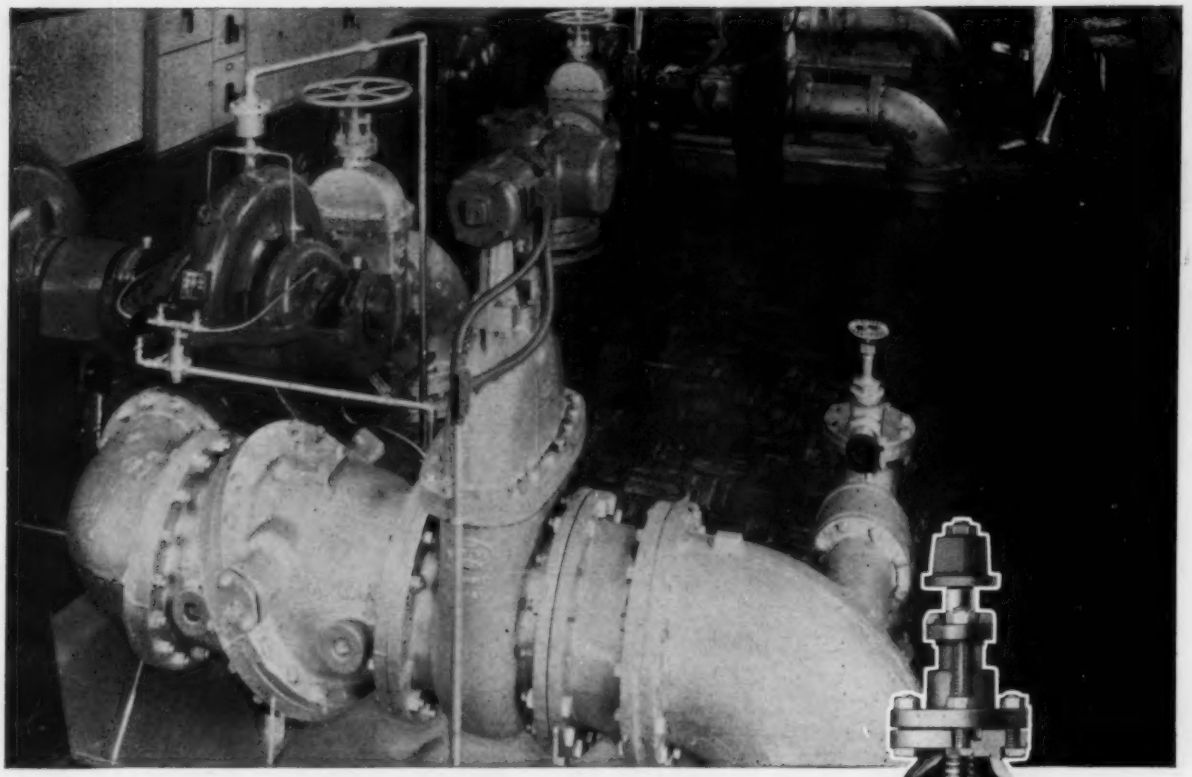
The City of Waco is to be commended for its foresight in providing equipment to assure adequate water supply, even during peak demand periods. Mr. Curtis Harlin is Superintendent of Water and Sewage, while Mr. W. J. Biederman is Plant Superintendent. J. J. Rady Company, Fort Worth, Texas were Consulting Engineers.

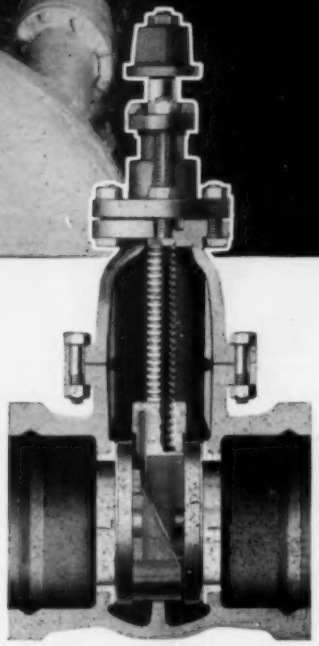
Answer your questions about porous media with this informative 56 page booklet. It's yours for the asking. Just write to the address below.

CARBORUNDUM

Registered Trade Mark

Dept. X-27, Refractories Division
The Carborundum Company, Perth Amboy, New Jersey





This cutaway shows the Darling principle that assures uniform wear distribution, automatic seating compensation, prolonged tight closure and unusual valve life.

Sustained top performance

. . . a **DARLING** gate valve bonus!

HERE'S a point to bear in mind about the Darling valves installed in this fine new water pumping station at Tonawanda, N. Y. As in so many other applications everywhere, those Darling gate valves are bound to grow old, in years, but they'll *stay young* in performance!

It's the precision manufacture and the Darling fully revolving double disc parallel seat principle that always makes a world of difference! It means prolonged tight closure, avoidance of trouble and low maintenance through the years.

Look into these facts . . . and make Darling gate valves *your* first choice. They are available in types, sizes and with the proper ends for virtually all requirements. Send for Bulletin 5403.

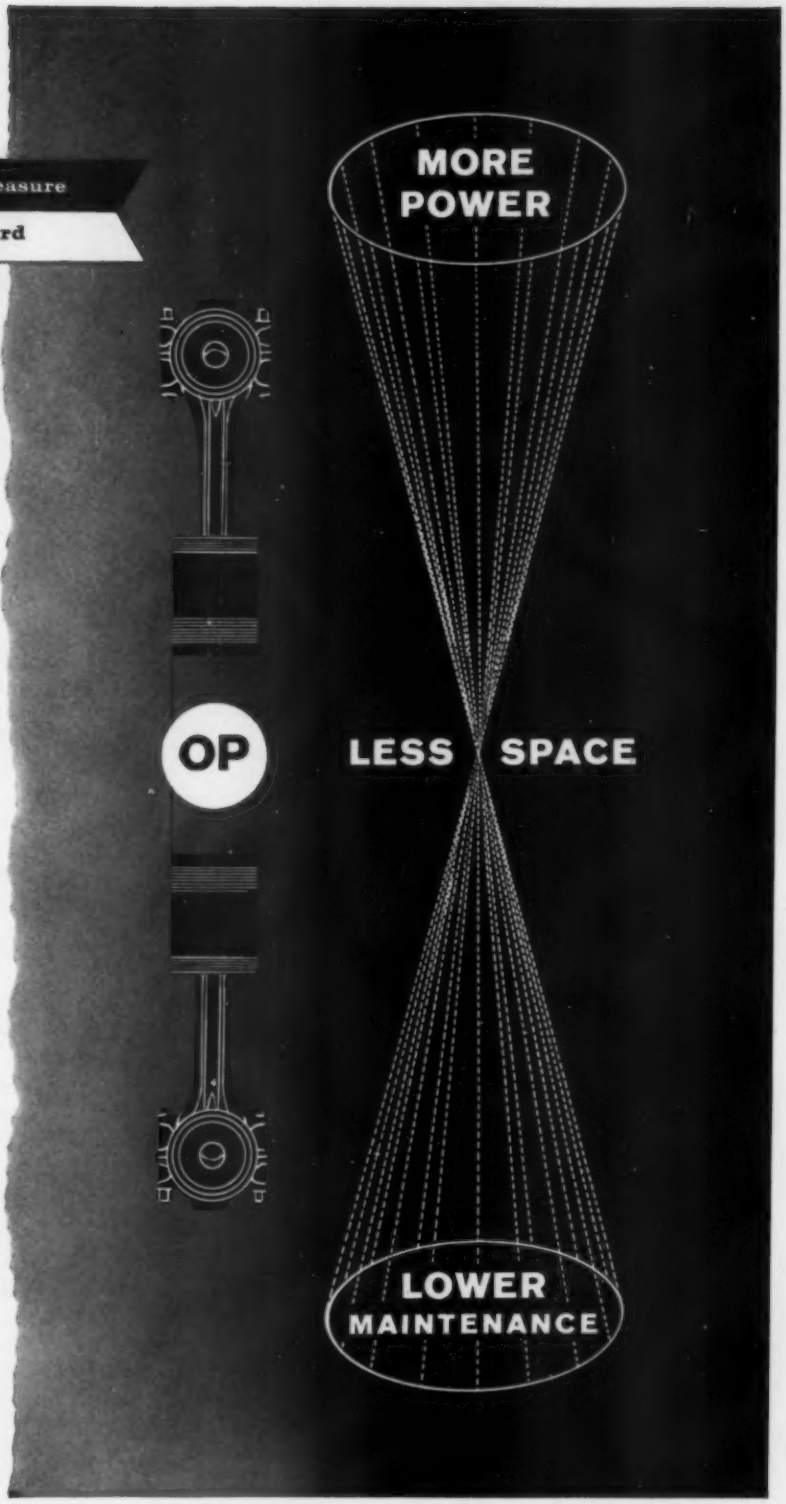
DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

Where performance is the measure

F-M Power is the standard



Only the Fairbanks-Morse Opposed-Piston Marine Diesels offer all these advantages:

Opposed-Pistons . . . of equal weight reacting to combustion in a single cylinder liner producing more power in less floor space with less weight—power that is instantly responsive with practically no vibration.

Two-Cycle Design . . . that completely eliminates more than 40% of the moving—wearing—parts found in engines of comparable horsepower. No cylinder heads, no valves or intricate timing with its attendant adjustments. Fewer parts automatically means less maintenance. Low B.M.E.P. further reduces wear.

Uniflow Scavenging . . . that eliminates crosscurrents, pockets. Provides greater horsepower, increased thermal efficiency for the utmost in fuel economy.

More Power... More Speed... More Maneuverability

Insist on an O-P for your vessel in the 300 to 2400 horsepower class and see what top performance, reliability and economy can mean on every trip. For complete information to get you started write: Fairbanks, Morse & Co., Dept. WSW-7, Chicago 5, Ill.

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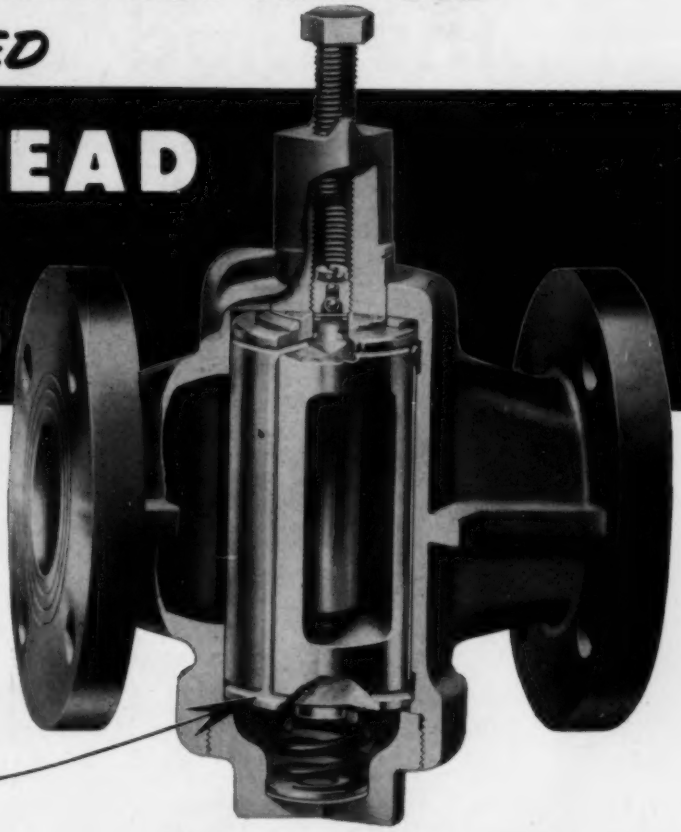
No. 5* of 12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED
HOMESTEAD *Lubricated* PLUG VALVES



*SELF-FREEING PLUG PREVENTS STICKING

Homestead's exclusive completely controlled lubricant system positively prevents sticking by its instant, piston-like movement of the plug downward at the start of each lubrication. Spring and line pressure return it to stem-sealed position.

This is only **one reason why you should buy and use low-priced** HOMESTEAD LUBRICATED PLUG VALVES.

HERE ARE ALL TWELVE

1. Extra long valve life assured by very close tolerance between sealing surfaces.
2. Straight line fluid flow—streamlined ports—minimum resistance to flow—minimum pressure drop.
3. Triple head seal—two lubricant rings and reinforced Teflon stem seal prevent leakage.
4. Easy turning—plug floated on Teflon washer and reinforced Teflon ring.
5. Self-freeing plug prevents sticking.
6. Full-threaded screw prevents dirt being forced into lubricant system.
7. Quarter-turn fully opens or closes.
8. Reinforced Teflon stem seal—no cold flow—continuous, positive seal.
9. Seating surfaces protected in both open and closed positions.
10. High pressure lubricant system provides full lubricant seal around ports.
11. Leak-proof double ball and lubricant sealed check valve. No springs. No maintenance.
12. Extruded Lubricant shows when system is full. No waste of lubricant.

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Without obligation, send Reference Book 39—Section 5 on HOMESTEAD LUBRICATED PLUG VALVES.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

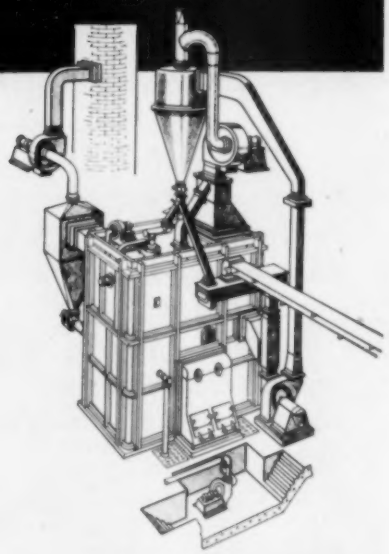
Dispose of Sewage Sludge the Modern Way

The widespread acceptance of the C-E Raymond System is based on its solid advantages. This compact system combines the principles of Flash Drying and Incineration in a unit in which filter cake can be reduced to a sterile ash . . . or flash-dried to a salable fertilizer and soil conditioner. Revenue from the latter is often sufficient to pay a substantial part of plant operating costs.

Either operation can be performed alone, or combined in any desired proportion. Effective high-temperature deodorization of stack gases is available for both processes.

A C-E Raymond System can mean an end to your community's sludge disposal problems . . . as it has in municipalities across the nation. Contact the Combustion office nearest you for specific recommendations. A C-E specialist will be glad to discuss your requirements and help plan an installation with you or your consultants.

B-998



COMBUSTION ENGINEERING

RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Cal.

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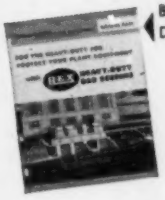

Bulletin 315-22 Heavy-Duty Bar Screens

Bulletin 315-62 Sludge Collector Specifications

Bulletin 315-41 Grit Collectors

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NOW AVAILABLE...your reference library on waste treatment

The answer to your problem of municipal or industrial pollution, or waste reclamation, may be found in the new Rex Bulletin 315-11. This bulletin describes various methods of waste treatment and the CHAIN Belt quality process equipment available to perform these functions reliably and efficiently.

If your specific problem is sludge or scum removal from rectangular tanks, the new Rex Bulletin 315-61 describes in detail the proved Rex Conveyor Sludge Collectors and Skimming Equipment which will do the job in the best possible way.

You or your engineers will find these two new bulletins helpful in selecting waste treatment equipment.

For data on other Rex products for waste and water treatment, detailed bulletins are available. These bulletins will help you select and specify the proper equipment for the job...equipment designed and built in the CHAIN Belt tradition of quality engineering and manufacture. Many of these bulletins include engineering and selection data.

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CHAIN BELT

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☐ 315-61 "Conveyor Sludge Collectors"

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Calgon† provides a simple, effective and economical solution to these and many other water problems. Fed at rates of only a few parts per million, Calgon stabilizes iron and manganese dissolved in water, prevents iron pick-up from pipes. Where water meter stoppage or Red Water presents a problem—Calgon is the answer.

Corrosion Control with Calgon is effective in minimizing tuberculation. Mains and pipes stay clean, keeping flows high and pumping costs low.

Calgon also inhibits the formation of lime scale in both naturally hard and lime softened waters. Filters, valves, mains, heaters and meters are kept clean, because Calgon keeps scale forming minerals in solution.

Years of experience with water problems of all kinds in every part of the country are available to you. A phone call or letter will put Calgon's technical know-how to work on your particular problem.

*Calgon is the Registered Trade Mark of Hagan Chemicals & Controls, Inc. for its glassy sodium phosphate products.

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CALGON COMPANY

A DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
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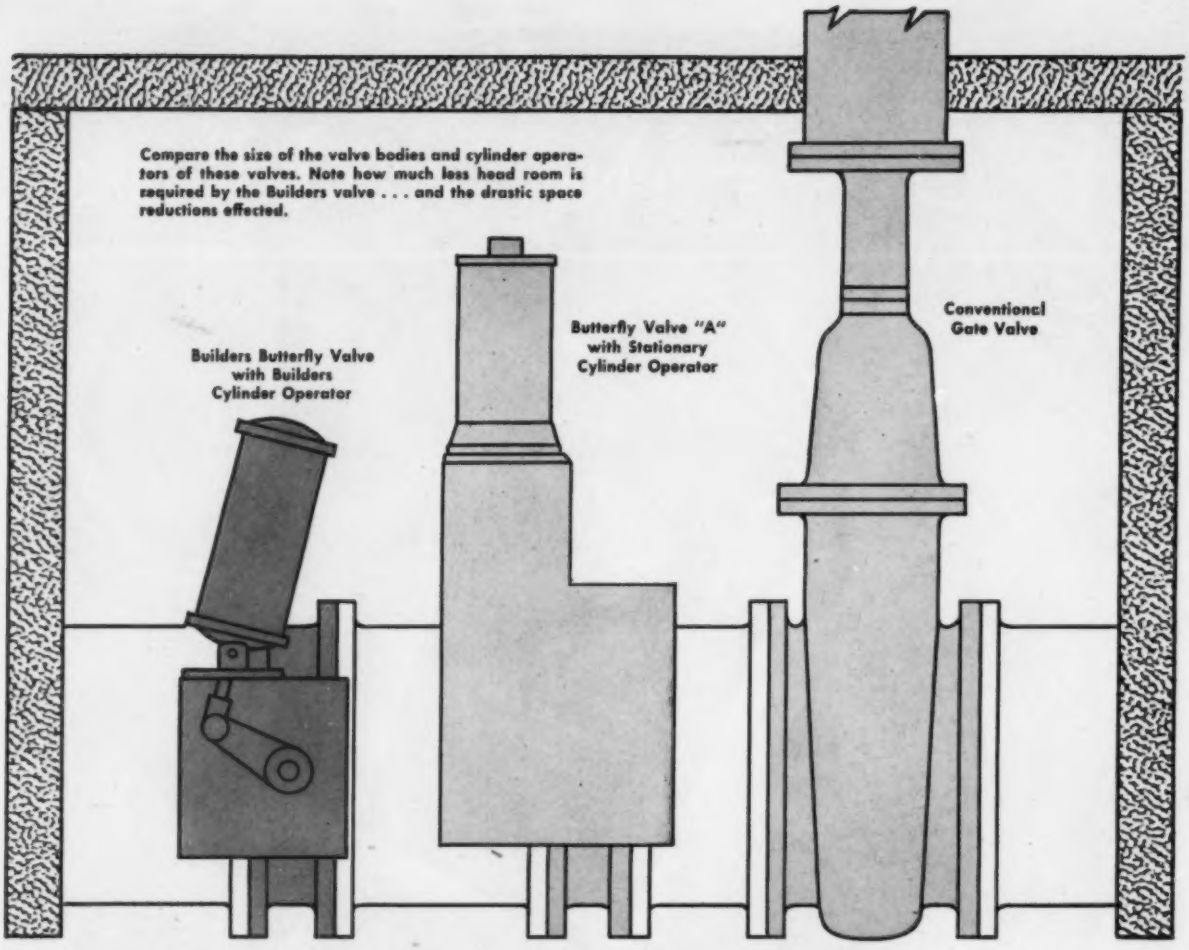
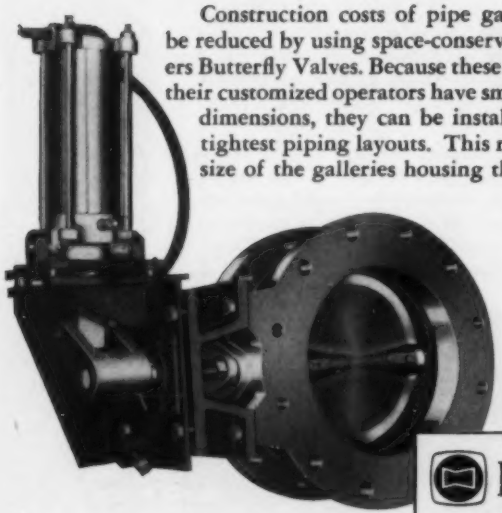

Compare the size of the valve bodies and cylinder operators of these valves. Note how much less head room is required by the Builders valve . . . and the drastic space reductions effected.
Builders Butterfly Valve with Builders Cylinder Operator
Butterfly Valve "A" with Stationary Cylinder Operator
Conventional Gate Valve

CUT CONSTRUCTION COSTS . . .

with compact Builders Butterfly Valves!



Construction costs of pipe galleries can be reduced by using space-conserving Builders Butterfly Valves. Because these valves and their customized operators have small overall dimensions, they can be installed in the tightest piping layouts. This reduces the size of the galleries housing them, eliminates the need for special construction and supports, and effects savings in both construction materials and labor. For the ultimate in installation convenience and application adaptability, request complete data on Builders "more-for-your-money" valves that easily meet (and surpass) all AWWA Specifications. Designed for water works and sewage service . . . made by the leading specialized supplier of water works and sewage equipment.

Write for Bulletin 650-LIB. Builders-Providence, Inc., 350 Harris Avenue, Providence 1, R. I.

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES
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Palatable Water Means Good Public Relations

The severest critic of the palatability of a water supply can be the casual visitor—tourist or salesman, because he can compare your supply with that of other communities. Ill-tasting water can also influence industries against settling in your town. Every water works official should strive to satisfy the severest critic, thereby pleasing the local consumers as well. Adequate usage of Nuchar activated carbon will assure delivery of a palatable water at all times, so that when your local consumers go travelling, they will return with that wonderful feeling—"There's no place like home."

AQUA NUCHAR ACTIVATED CARBON'S adsorptive ability covers a wide range of taste- and odor-producing bodies. John R. Baylis has stated "All tastes and odors likely to be present in a water supply can be removed with activated carbon. We find a few statements in the literature on water treatment that the taste or odor was not removed by the addition of carbon, but almost invariably the reason was that not enough carbon was used.

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Efficient, *high-rate* "BIOSORPTION" plant installed at Neillsville. Consulting Engineers — Davy Engineering Co., La Crosse, Wis.

B.O.D. removal in half the space and half the time!

The PROBLEM: To provide 80% B.O.D. removal from domestic sewage and milk plant wastes combined as follows:

	G.P.D.	POP. EQUIV.	B.O.D. lbs.
Domestic sewage	278,000	3132	522
Milk plant #1	24,400	2658	443
Milk plant #2	39,800	2052	342
	342,200	7842	1307

The SOLUTION:

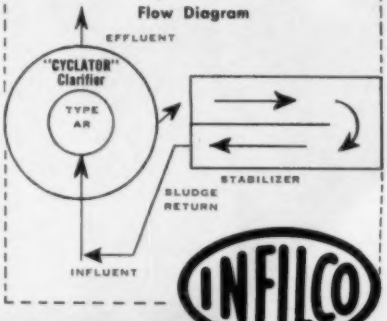
The "BIOSORPTION" activated sludge plant illustrated above was installed for maximum capacity in minimum space — highest efficiency at lowest cost. Equipment includes a CYCLATOR® clarifier combining mixing and clarification in a *single* basin; Stabilizer with 120 COLAFLEX® diffusers; GRIDUCTOR® comminutor, and digester.

The RESULTS: Typical hourly samples composited for analysis:

1956 Date	Time	Ave. Flow M.G.D.	B.O.D. Raw Sewage P.P.M.	B.O.D. Percent Removal	Suspended Solids Raw Sewage P.P.M.	Suspended Solids Percent Removal
Nov. 21	9 A.M.-4 P.M.	0.262	1330	80.9	—	—
Nov. 27	8 A.M.-4 P.M.	0.226	741	83.7	366	78.2
Nov. 28	8 A.M.-4 P.M.	0.248	794	88.4	480	83.3
Dec. 3	8 A.M.-4 P.M.	0.232	642	80.5	508	84.2

If your problem involves greater capacity in *less* time — from *less* space — *at lower cost* — consult INFILCO because INFILCO KNOWS HOW to help you solve it. Write today for full information on this installation and Bulletin No. 6550.

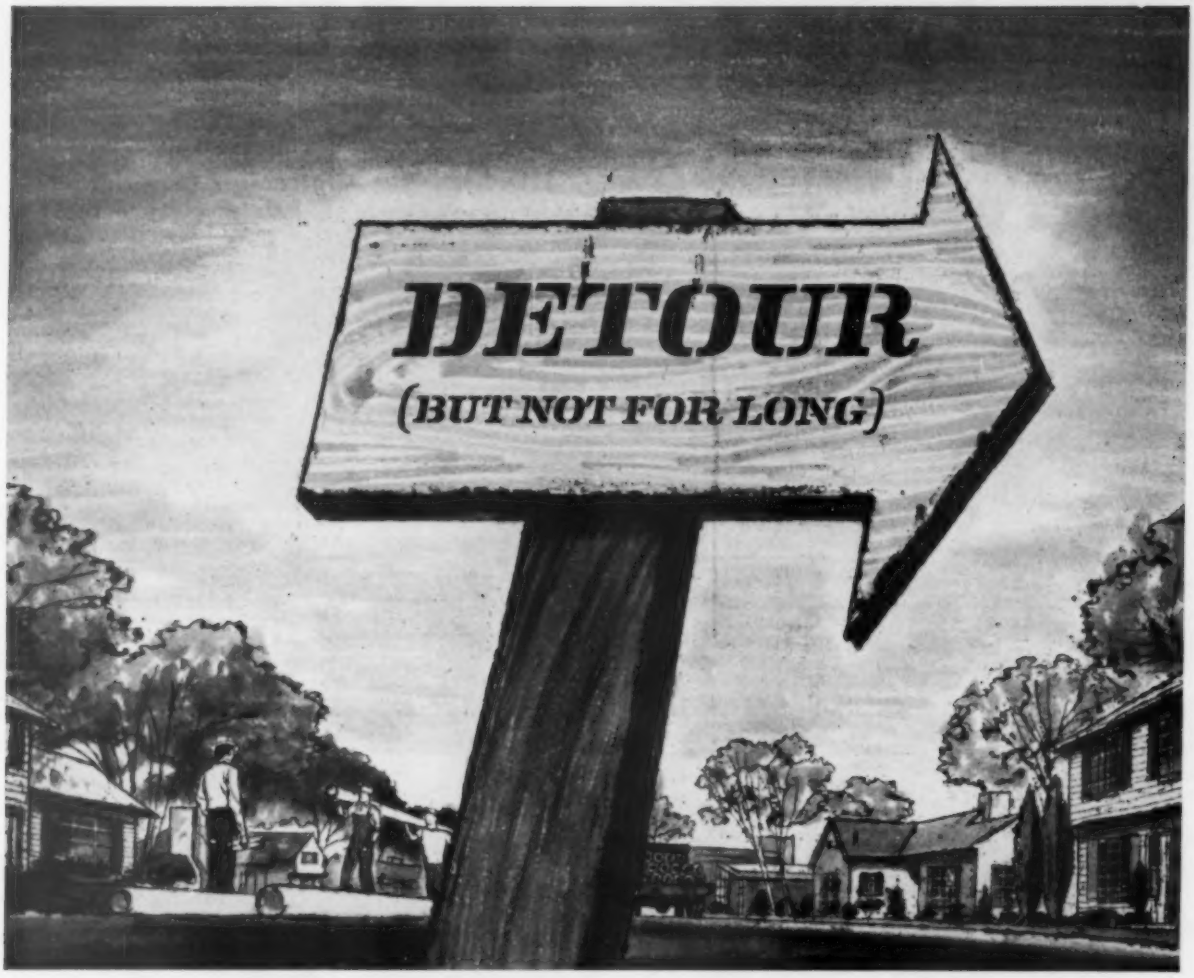
Inquiries and samples are invited on all water, sewage and waste treatment problems.



INFILCO

INFILCO
INCORPORATED
General Offices • Tucson, Arizona • P.O. Box 5033
Field offices throughout the United States
and in foreign countries

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste conditioning — coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment. 57423



Transite Sewer Pipe installs fast... to last!

...keeps installed costs lower... licks infiltration, root clogging

Transite's Ring-Tite Coupling prevents two major sewer line problems. It locks out roots . . . seals out ground water!

Its Ring-Tite Coupling is quickly assembled, provides a tight, long-lasting seal!

IN A SEWER PIPE INSTALLATION, you want a good "tight" system . . . and you want it completed fast! You get both of these advantages as well as long life and operating efficiency with Transite® asbestos-cement Pipe and the Ring-Tite® Coupling.

Why? Because lightweight Transite reduces handling costs, speeds work above and below ground. Quickly-assembled with the Ring-Tite Coupling, Transite Pipe ends are joined easily . . . *surely!* And to give you a tight long-lasting joint, rubber sealing rings in the Ring-Tite Coupling are tightly compressed between sleeve and pipe to lock out roots and overcome infiltration problems.

Another advantage of Transite Sewer Pipe is its smooth interior; its coefficient of flow is n=0.010. This results in substantial savings—lets you use smaller diameter Transite Pipe, or permits laying to flatter grades.

Let us send you booklet TR-165A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville

TRANSITE SEWER PIPE WITH THE RING-TITE COUPLING

The Pentagon installs a COILFILTER

U.S. Army Photo from United Press

Sewage from the Pentagon, and several other nearby Federal buildings, is treated in a trickling filter plant. A large area of glass covered sludge drying beds was formerly used, but sludge took too long to dewater in cold or humid weather. This resulted in overloaded digesters, which adversely affected operation of the entire plant.

To solve this problem inexpensively, Komline-Sanderson Engineering Corp. has provided a 100 sq. ft. COILFILTER Package Unit on a concrete slab over one of the beds. This permits sludge dewatering on a routine schedule, unaffected by weather conditions.

Write for new 16 page Bulletin No. 106, "The Coilfilter Story."

KOMLINE-SANDERSON ENGINEERING CORPORATION
Peapack, New Jersey

MANUFACTURERS OF COILFILTER SLUDGE VACUUM FILTERS

Into the ground with ease, and for keeps

K&M ASBESTOS CEMENT PIPE

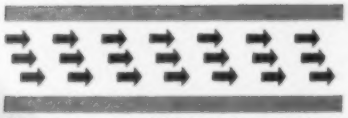
It's the modern pipe! Easy installation under any weather and ground conditions is just one of the advantages of K&M Asbestos-Cement Pipe. Other advantages: Permanently smooth non-tuberculating bore; non-corroding inner and outer surfaces; high resistance to electrolytic action; permanence of joint obtained quickly with exclusive K&M "Fluid-Tite"® Coupling.

K&M Pressure Pipe meets A.W.W.A., A.S.T.M., and U.S. Federal Specifications, and has Underwriters' Laboratories approval for all sizes (pipe and couplings) in Class 150.

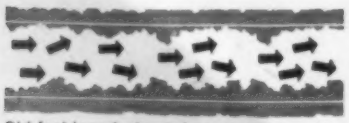
FOR GRAVITY SEWER SYSTEMS, K&M Sewer Pipe is the low-cost answer. "Fluid-Tite" Coupling makes permanent tight joint, prevents infiltration and root entrance.

FOR HOUSE-TO-SEWER CONNECTION, K&M Building Sewer Pipe and 2-step couplings round out the K&M family of asbestos-cement pipe.

Get the whole story on the modern pipe from the K&M distributor.



After many years, K&M Pipe hasn't tuberculated, bore remains unchanged, and full flow continues.



Old-fashioned pipe tuberculates over the years, requires higher pumping pressure, frequent cleaning.

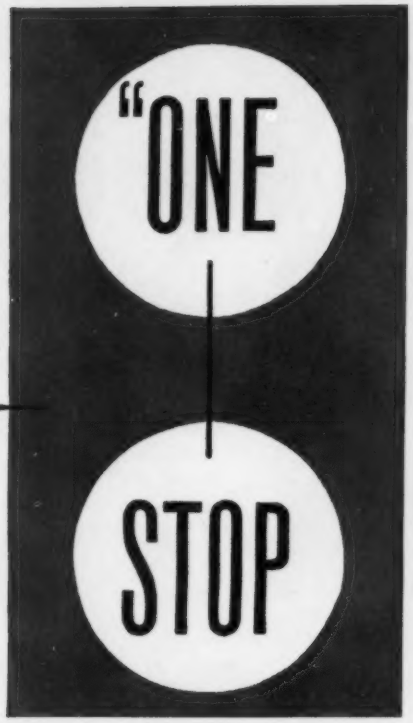
K·M
BEST IN ASBESTOS

KEASBEY & MATTISON Company • Ambler, Pennsylvania

In Canada, it's ATLAS ASBESTOS CO., Ltd., 5600 Hochelaga St., Montreal, P.Q.

for "CENTURY" Pipe and "FLUID-TITE" Coupling

you can profit from



SHOPPING"

for all your instrumentation needs...

Here's how—order your instruments from Honeywell:

You'll get a complete control system, engineered for your specific needs with *standard* products . . . by men who know your process. Controls are selected from a line which no other manufacturer can match for completeness.

- You'll gain the advantages of dealing with a single reliable source, the world's largest manufacturer of controls . . . save in purchasing, installation and maintenance.
- You're assured of complete and continued satisfaction because Honeywell assumes full responsibility for your control system . . . with service when you want it from over 110 Honeywell branch offices.

Call your nearby Honeywell sales engineer for complete facts and figures. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

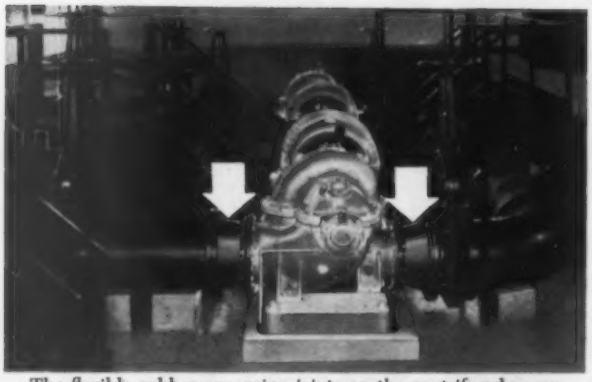
Honeywell

H HONEYWELL *First in Controls*

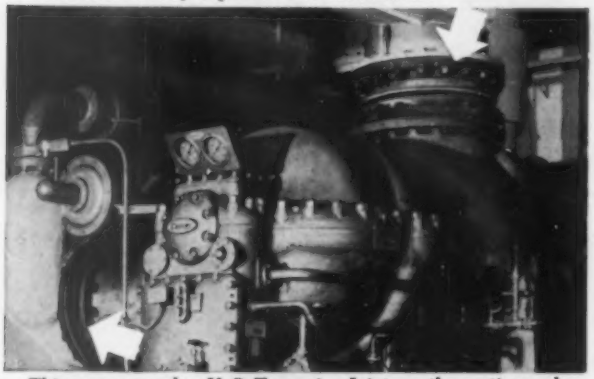
US RUBBER

EXPANSION JOINTS

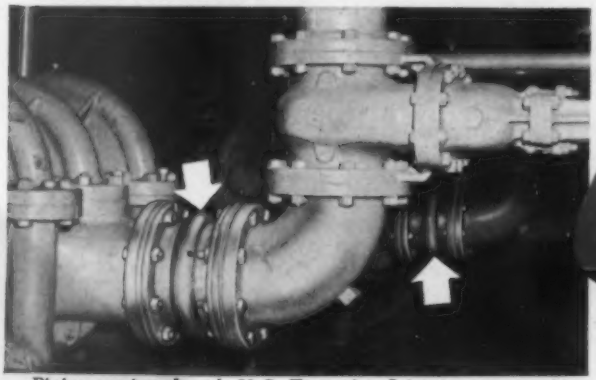
Expanding the Designer's Scope



The flexible rubber expansion joints on the centrifugal pump installations (above) are made by U. S. Rubber. They prevent stresses caused by expansion and contraction.



This compressor has U. S. Expansion Joints on the suction and discharge lines. Like all U. S. Joints, these insulate against the transfer of vibration and noise.



Piping equipped with U. S. Expansion Joint to compensate for any misalignment caused by load stresses, wearing of parts or settling of building.

U. S. Rubber Expansion Joints are resilient and therefore do not, like metal, set permanently when compressed. Constant flexing merely keeps them alive... prevents brittleness.

- They absorb both axial and lateral deflection far more than metal joints. Greater insulation against vibration and pump noises. No electrolysis, corrosion or erosion.
- Handle pressures from 40 lbs. to 125 lbs.
- The outside diameter of the arch is smaller than on metal joints. (Face-to-face dimensions, even with multiple arches, are smaller.)
- Weight is much less. This, plus the fact that no gasket is needed between flanges (metal joints require gaskets) results in an easier installation lowering the cost.

"U. S." was the *first* to develop expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems. Some are still in service, after 30 years of operation. Obtainable at any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

For the complete technical information catalogue on the entire line of U. S. Rubber Expansion Joints, contact your nearest "U.S." District Sales Office or write us at Rockefeller Center, New York 20, New York.

US RUBBER

Mechanical Goods Division

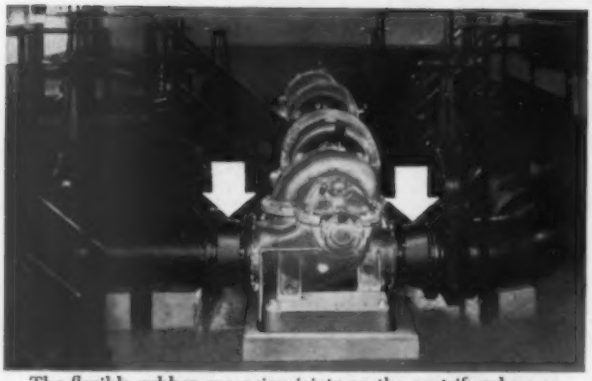
United States Rubber

DESIGNED, FABRICATED AND ERECTED BY

GRAVER

US RUBBER EXPANSION JOINTS

Expanding the Designer's Scope



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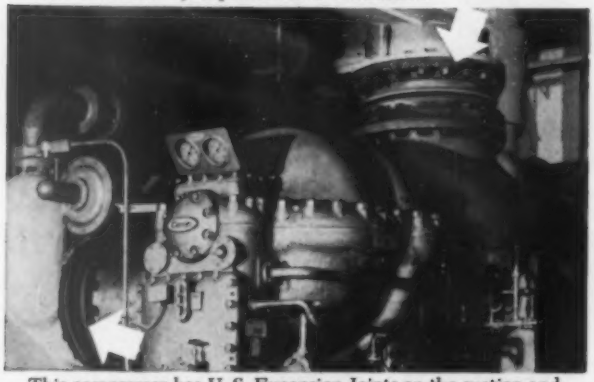

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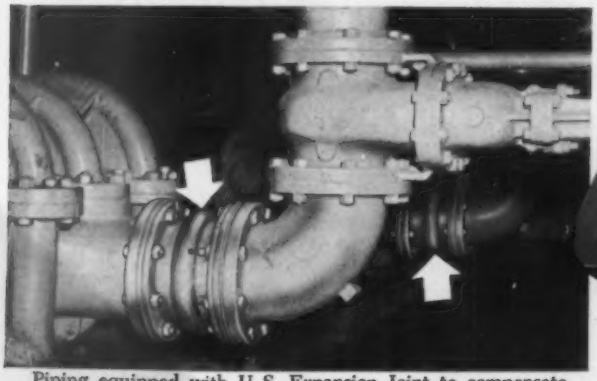

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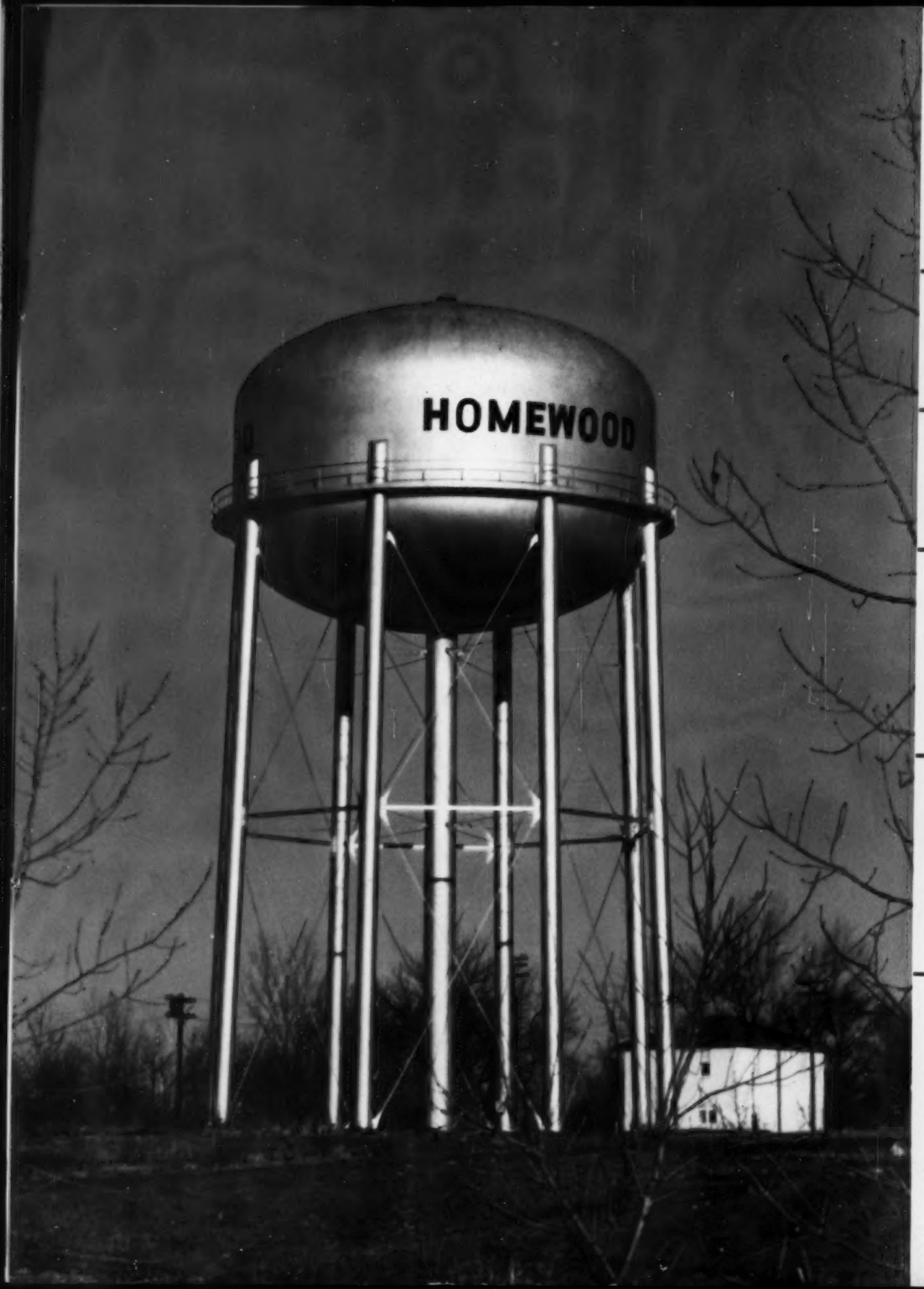
US RUBBER Mechanical Goods Division

United States Rubber



FILE REFERENCE

FACT SHEET

GRAVER®

Elevated Water Tank for the Village of Homewood, Illinois

T. G. Bernhardi, Village President
Alan Webster, Village Manager
Baxter & Woodman
Consulting Engineers
Crystal Lake, Illinois
Graver Tank & Mfg. Co., Inc.
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 500,000 gallons
Height to Overflow: 101′ 8″
Low Water Level: 71′ 8″
Diameter of Tank: 55′ 0″
Built to AWWA Specifications
Painted and Sterilized

THE PROBLEM

Homewood, a rapidly expanding suburban community which has increased in population from 5,887 to 10,600 from 1950 to 1953, found itself with serious water distribution problems. While new wells and new storage tanks had been added over the years as demand dictated, and total well capacity was ample, the system had become badly out of balance. Mains were not adequate to maintain optimum pressure in all sections of the village. A large part of the growth was in the west side of town, where no storage existed to meet peak demands.

THE SOLUTION

The application of standard empirical formulae indicated that the addition of a 500,000 gallon elevated tank in the west section and the addition and replacement of certain water mains would provide normal water pressure for all areas. This work, it was concluded, would be adequate to take care of the 21,500 population that is expected by 1980.

Graver was selected to design, fabricate and erect the new 500,000 gallon elevated water tank. The contract covered a turnkey job, including construction of foundations, making the pipe connections, painting, sterilizing, grading and seeding.

It will be advantageous to talk over your water storage problem with a qualified consulting engineering firm and Graver. Graver's 100 years of experience in tank fabrication and erection, employing the most advanced techniques, is worth having. Telephone or write:

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA

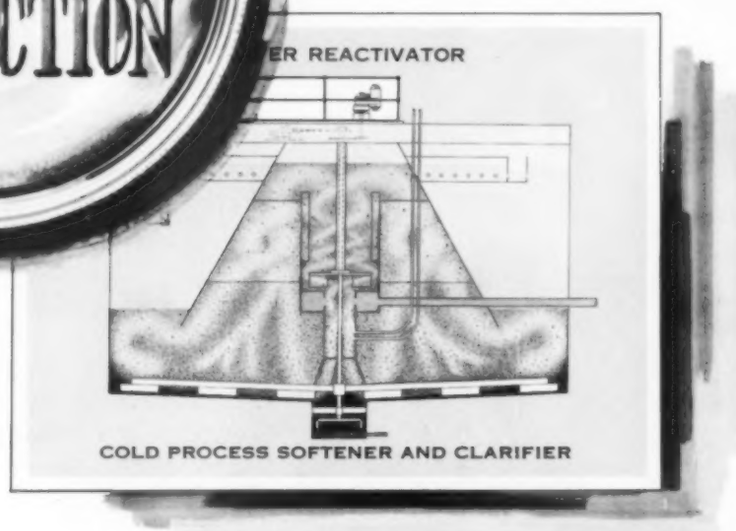
New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Detroit • Chicago • Tulsa • Sand Springs, Oklahoma • Houston • Los Angeles
San Francisco • Fontana, California

Our 100th Year

GRAVER

DESIGNED, FABRICATED AND ERECTED BY

DESIGN of DISTINCTION



The distinctive design of the Graver Reactivator®, proven in hundreds of installations, combines *all* four of these important features in *one* unit: *1. Controlled Sludge Recirculation, 2. Separately driven Sludge Scraper, 3. Low Sludge Level, 4. Sludge removal over entire bottom area*

WRITE FOR
DESCRIPTIVE
CATALOGUE
WC-103A

Municipal Dept. M-113

GRAVER®

GRAVER WATER CONDITIONING CO.

A Division of Graver Tank & Mfg. Co., Inc.

216 West 14th Street, New York 11, N. Y.

CLOW BELL-TITE CAST IRON PIPE

costs less to buy, less to lay!

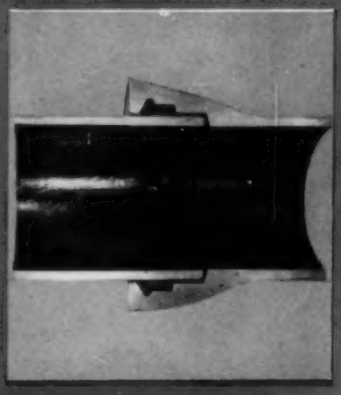
Assembly is simple. First, the joint is wiped clean.

Second step — insert gasket as shown into groove in bell.

Third — apply thin film of special lubricant to the gasket.

Next—push home the spigot, first centering plain end in bell.

No bell holes are required. Installation is very rapid.



Result—a safe, economical joint with a tight, permanent seal.

The NEW CLOW BELL-TITE cast iron pipe joint is a rubber seal joint that requires NO bolts, NO nuts, and requires NO wrenches to lay. It takes less time to install. It costs less to buy. Here's economy PLUS.

The Underwriters' Laboratories, after testing the joint, have approved its use for water working pressures up to 350 psi. CLOW BELL-TITE pipe barrel meets all quality provisions and physical requirements of all applicable ASA, AWWA, and/or Federal Specifications for cast iron pipe.

SINCE 1878

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries: Eddy Valve Company, Waterford, New York • Iowa Valve Company, Oskaloosa, Iowa

Now SAVE TIME

USE MUELLER COPPER

WHY USE A METER YOKE?

Because a meter yoke provides a tailor-made setting for your meter with fewer joints and fittings—reduces installation time. New service lines may be completed and backfilled without the meter. Meters are then quickly added—or removed—at anytime without disturbing the piping.

The yoke becomes a permanent part of the piping system and absorbs piping stresses to protect your meter and insure accurate measurement and full revenue. And yokes raise your meters out of the debris and moisture at the bottom of the meter box for easier, more dependable readings and greater accessibility.

Yes, meter yokes give you the ideal setting for all your water meters—inside or outside.

WHY USE A MUELLER COPPER METER YOKE?

Because a Mueller *Copper* Meter Yoke gives you greater flexibility for faster, easier installation—even when service pipe is out of line. And corrosion resistant seamless copper tubing with sweeping curves gives full pipe capacity flow indefinitely with practically no maintenance.

Properly spaced and accurately aligned swivel nuts aid quick meter installation or removal. All swivel nuts are drilled to permit sealing meter.

Special, ribbed body design provides ample strength to absorb piping stresses and prevents drilling through body to by-pass meter.

And Mueller's special multi-purpose end connections reduce your inventory! Outside I. P., inside I. P., copper or any combination of these connections may be made by stocking only one type of yoke with additional tailpieces.

Mueller's complete line includes a copper water meter yoke ideally suited to fit your individual needs.

not enough space for a meter yoke?

USE A MUELLER ANGLE METER STOP!

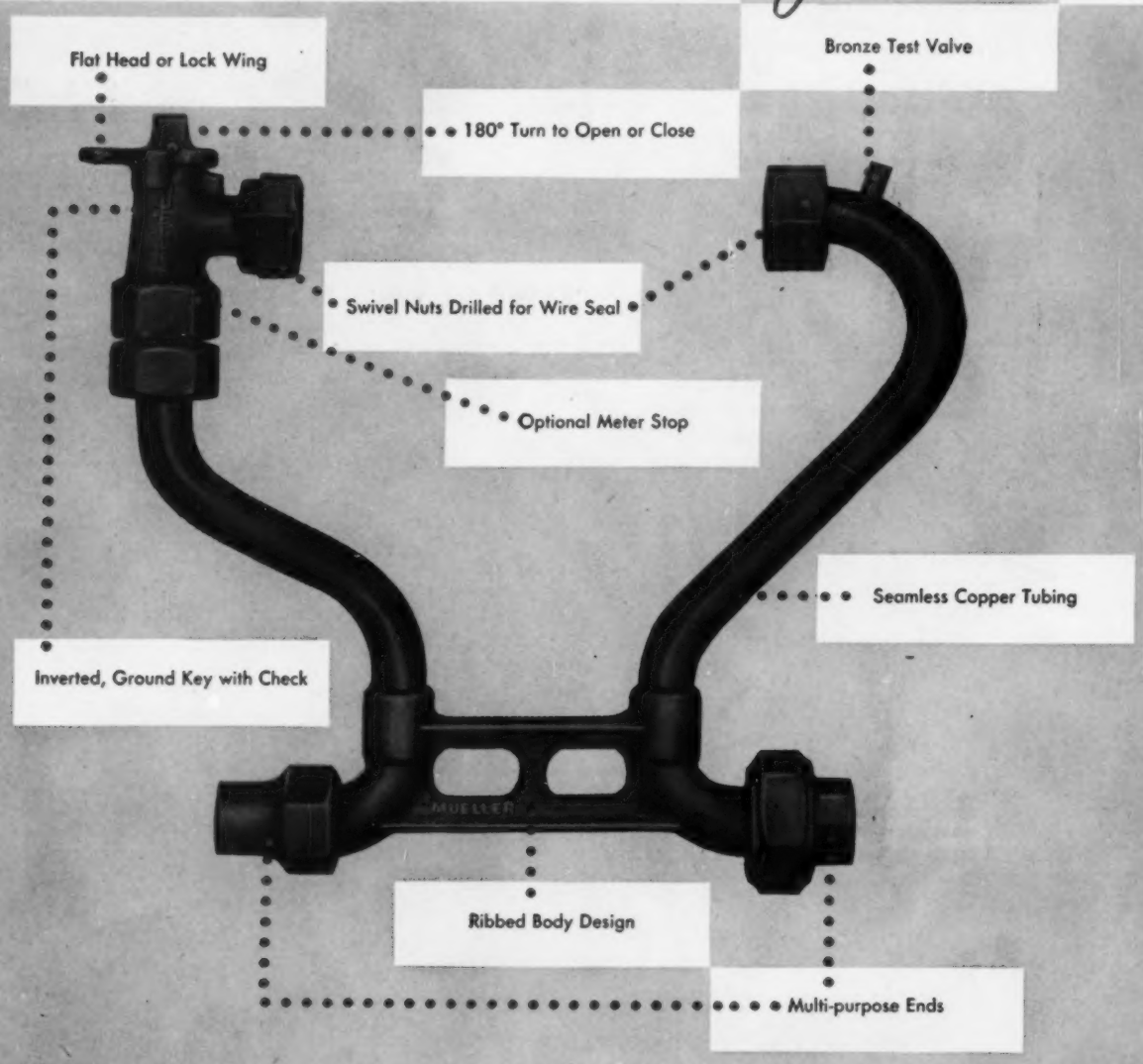
Mueller Angle Meter Stops give you many of the advantages of copper meter yokes and may be used separately in extremely confined locations. Inside I. P. or copper connections.

. . . see your Mueller Representative today!

AND MONEY SETTING WATER METERS ...

METER YOKES!

check these time and money saving ***features***



Since 1857

MUELLER CO. 100th YEAR SERVING the Water and Gas Industries QUALITY

MUELLER CO.
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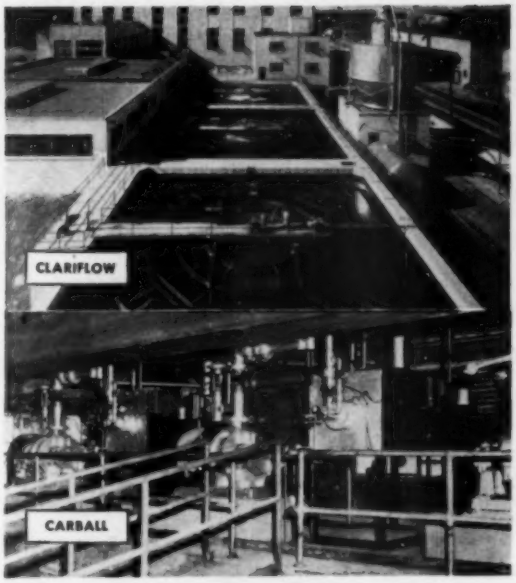
Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

WALKER PROCESS

Equipment for All Water, Sewage and Waste Treatment Processes



WATER TREATMENT

CLARIFLOW—a short retention, vertical rise clarification unit combining chemical homogenizing, flocculation, clarification and positive sludge removal for softening and turbidity, color and algea removal. Designed for rectangular, square or circular basins.

CARBALL—produces a clean, tasteless CO_2 gas for carbonation. Burns either oil or gas at high temperature and pressure resulting in dry, clean CO_2 suitable for direct diffusion into carbonation chamber.

SEWAGE AND WASTE TREATMENT

HEAT-X—a complete digester sludge heating unit including heat exchanger, boiler, burner and all controls. Burns sewage gas, oil and natural gas, singly or in combination. Absolute and independent control over each function of sludge heating.

DIFFUSAIR—aeration equipment for mixing and oxygenation of tank liquors. Self cleaning air Spargers do not clog or cause back pressure build-up on blowers. High rate tank turn-over and oxygenation results in greater plant capacity.

INDUSTRIAL LIQUIDS

INDUSTRIAL THICKENER—adapts the CLARIFLOW principle to blast furnace flue dust thickening, oil separation, paper stock reclamation and other applications. Permits reuse of process water and reclamation of valuable waste on many industrial installations.

COLLECTORS—for sludge removal in rectangular, square or circular sedimentation basins. Wide range of capacities and sizes to meet all water, sewage and industrial treatment requirements. Designed to suit the most exacting specifications.

WALKER PROCESS EQUIPMENT INC. · Aurora, Illinois

FOR THE BEST IN *Water Meters* go ALL AMERICAN

AMERICAN METERS

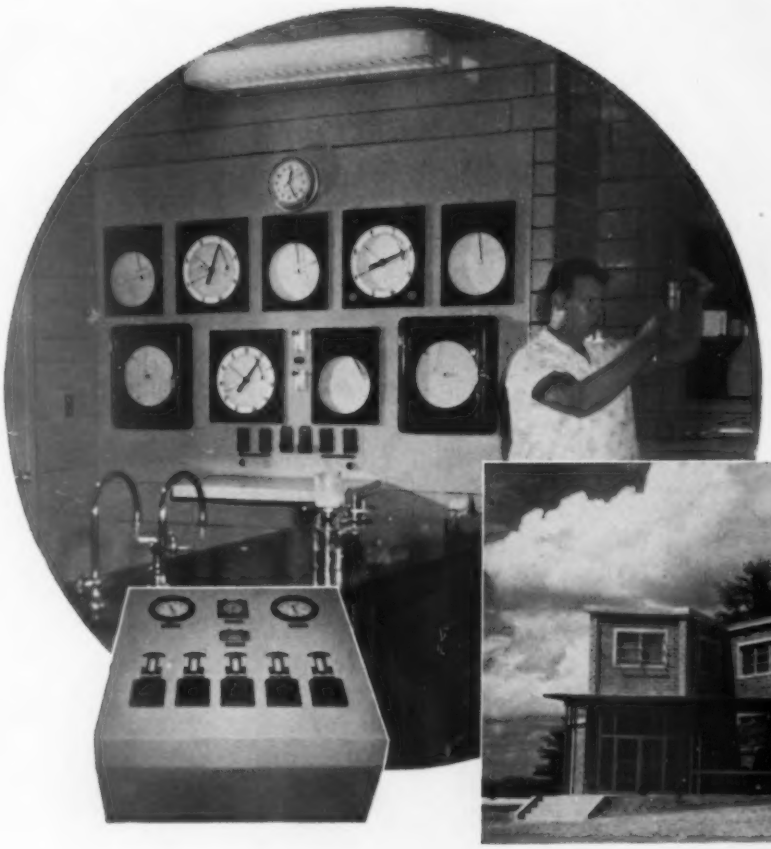
Lead in Advanced Engineering

Note these features that make American Meters leaders in advanced design.

1. Sealed plastic register box eliminates problems from flooding in pits or from moisture condensation. Register repairs are practically eliminated.
2. New O-ring stuffing box eliminates need for frequent retightening of packing.
3. Most complete frost protection — separable gear train and chamber plus pretested frost bottom. Breakage of frost bottom is independent of degree of tightening of flange bolts.
4. Thickest measuring disc of any meter, compels full registration.
5. No locating pins, guides or screws required to assemble works in casing. Works cannot corrode into casing to cause difficult removal.
6. Change gear meshing can be inspected after placing register on meter.

To be sure the meters *you* buy, have the latest engineering features — "go all AMERICAN."

BUFFALO METER CO.
2909 MAIN STREET BUFFALO 14, NEW YORK



Valdese Filtration Plant (below), designed by W. K. Dickson & Co., built by Boyd and Goforth, Inc. Complete operating data for the plant is concentrated on Honeywell panel, at left. Below at left is one of the consoles for controlling filter operation.

Honeywell FiltermatiC* System automatically controls rapid sand filters

THE Valdese Water Filtration Plant, Valdese, N. C., is designed for maximum simplicity and convenience. Complete supervisory data on the entire operation is concentrated on a Honeywell panel . . . and individual control consoles are provided at each filter location.

The Honeywell FiltermatiC System includes direct pneumatic operation of filter control valves, without need for complex pneumatic-hydraulic relays. Valves 16" and larger can be opened or closed at the turn of a switch. Rate of filtration, too, is a single switch adjustment . . . and control provides for automatic plant shutdown when levels in reservoir and clear wells reach maximum limits.

FiltermatiC Systems are available in a variety of forms . . . offer a unique combination of design, operating and maintenance features which assure low initial cost and continuing economy. Components are compact and free from the limitations of cables and mechanical linkages. Spare parts requirements are reduced by the use of interchangeable units. Maximum effectiveness is accomplished with minimum attention.

Ask your local Honeywell sales engineer to discuss your specific filtration requirements . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

*Trademark of Minneapolis-Honeywell Regulator Co.

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

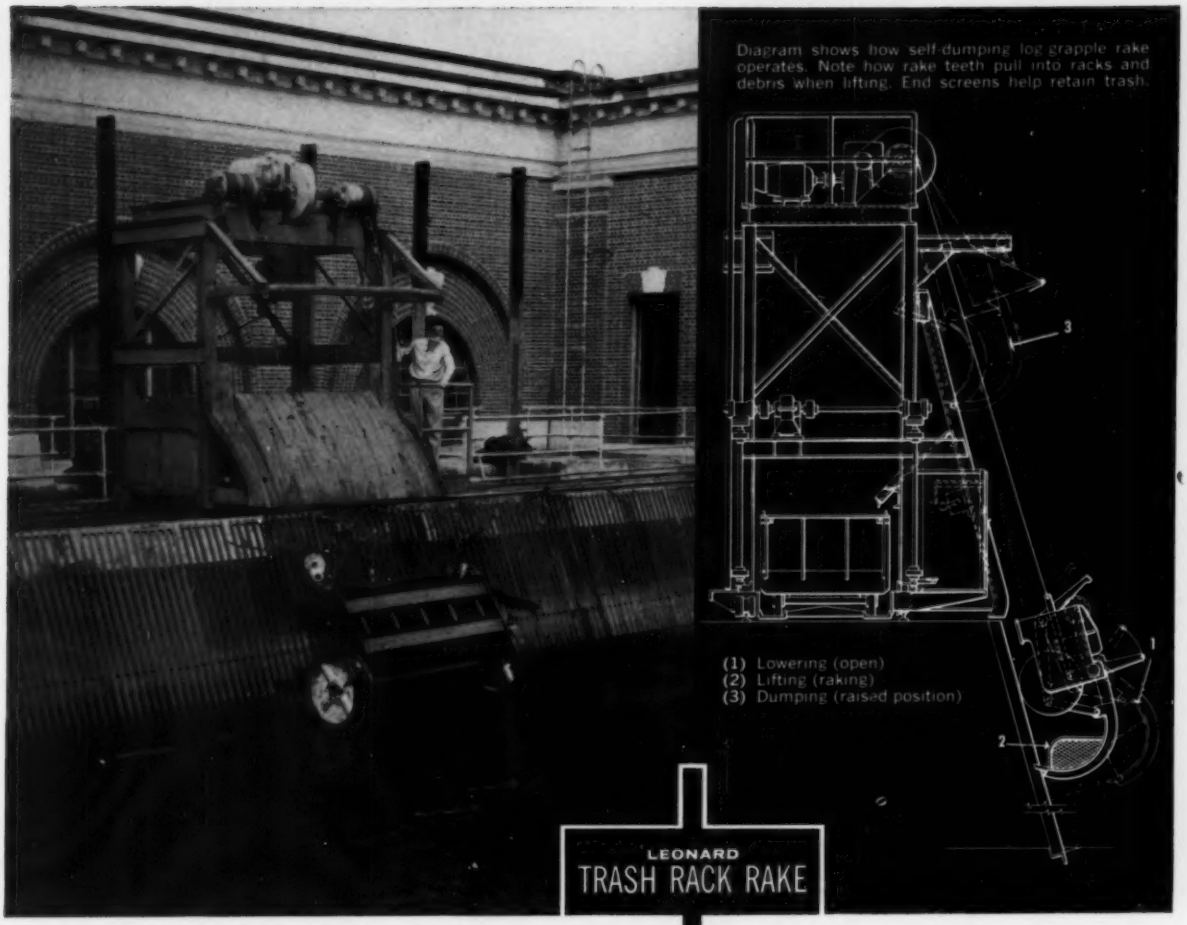


Diagram shows how self-dumping log grapple rake operates. Note how rake teeth pull into racks and debris when lifting. End screens help retain trash.
(1) Lowering (open)
(2) Lifting (raking)
(3) Dumping (raised position)
1
2
3
LEONARD
TRASH RACK RAKE

New 8-foot, self-dumping SMS rake at Niagara Mohawk Power Corporation's Black River Station is one of five recently installed by this company.

Two New Self-Dumping SMS Trash Rake Designs CUT CLEANING TIME AND LABOR

Now SMS offers you two improved Leonard trash rack rakes, both regular and log-grapple types. These self-dumping rake designs make operation easier and quicker, permit you to clean a greater area faster. Both new rake types are now available as additions to the SMS line of standard rake designs.

SMS Leonard rakes operate directly on trash rack bars . . . ride down over stubborn obstructions and work them loose. Such freedom of movement assures fast, easy cleaning. Initial costs are low because the width of SMS rakes can be kept to the minimum required for handling for trash and the expense of guides attached to racks, or embedded in piers is eliminated. These rakes are of simple and rugged construction, designed for outdoor service and require minimum maintenance.

For full information on trash rakes and other SMS accessories, write to S. Morgan Smith Co., York, Penna. Request Bulletin 158 on Leonard rakes, or Bulletin 158A on new, self-dumping rakes.

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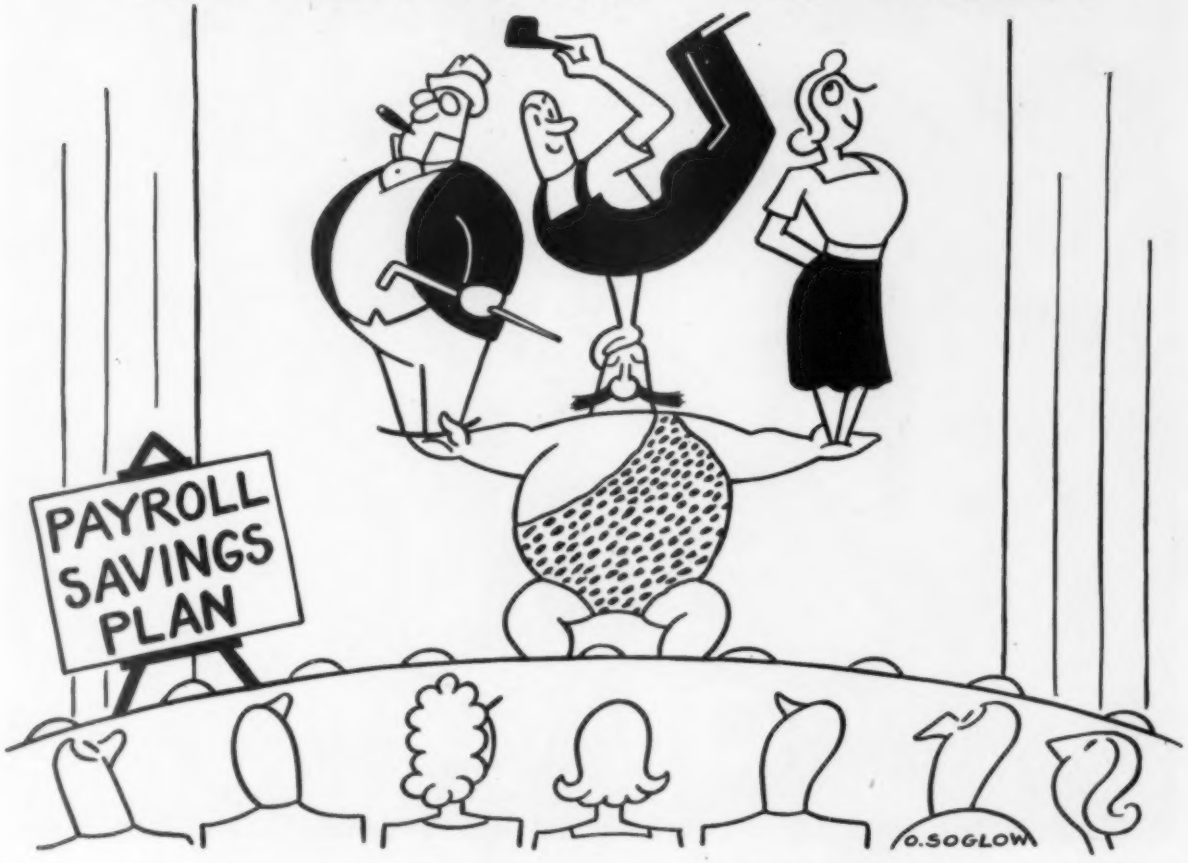

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Security breeds confidence—and confidence stimulates job interest and results in steadier people who are far more efficient in their work. Receiving those crisp Bonds at regular intervals along with their paycheck is an added inducement for employees to stay on the job.

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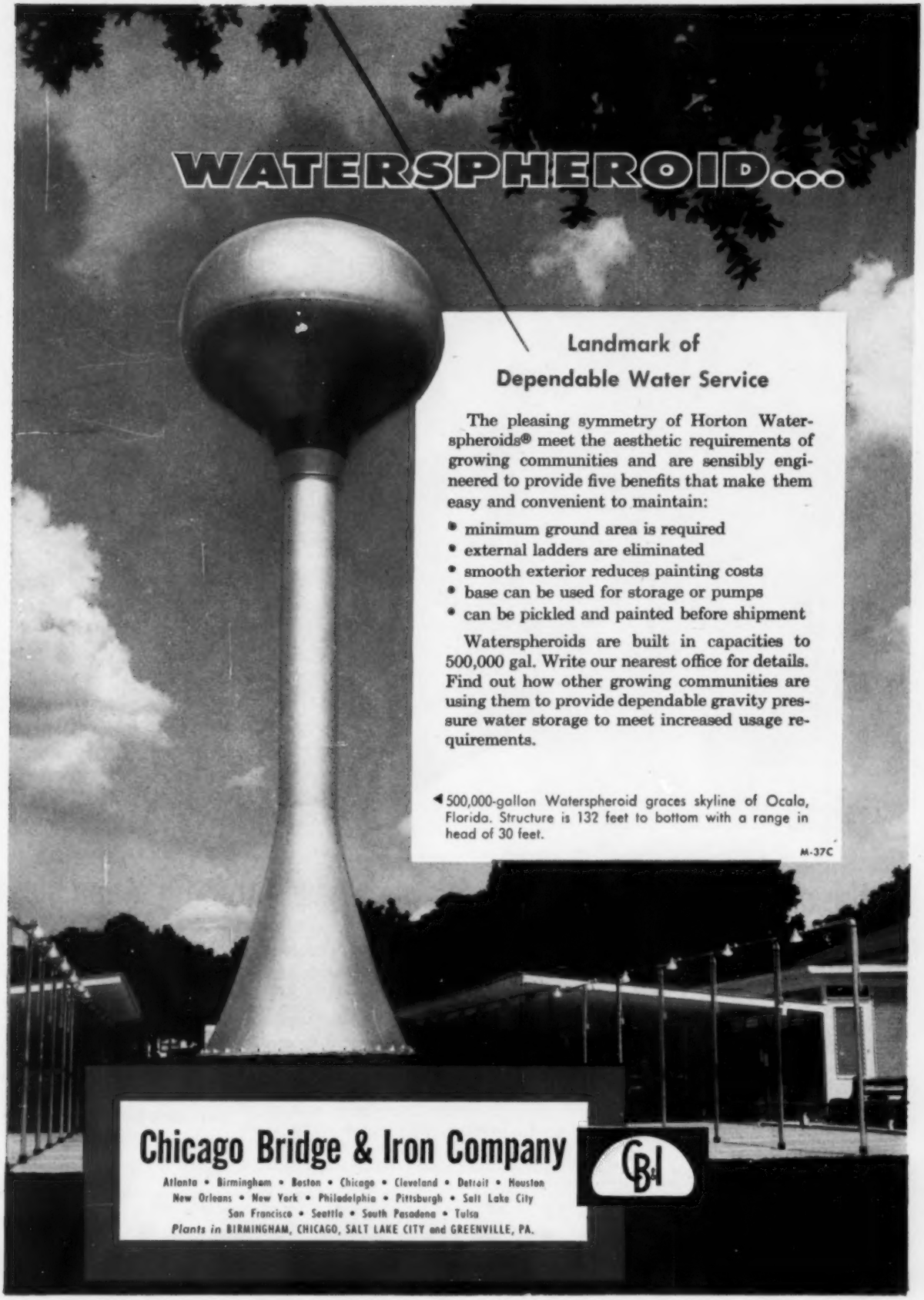
WATER & SEWAGE WORKS



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The pleasing symmetry of Horton Waterspheroids® meet the aesthetic requirements of growing communities and are sensibly engineered to provide five benefits that make them easy and convenient to maintain:

- minimum ground area is required
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- smooth exterior reduces painting costs
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Waterspheroids are built in capacities to 500,000 gal. Write our nearest office for details. Find out how other growing communities are using them to provide dependable gravity pressure water storage to meet increased usage requirements.

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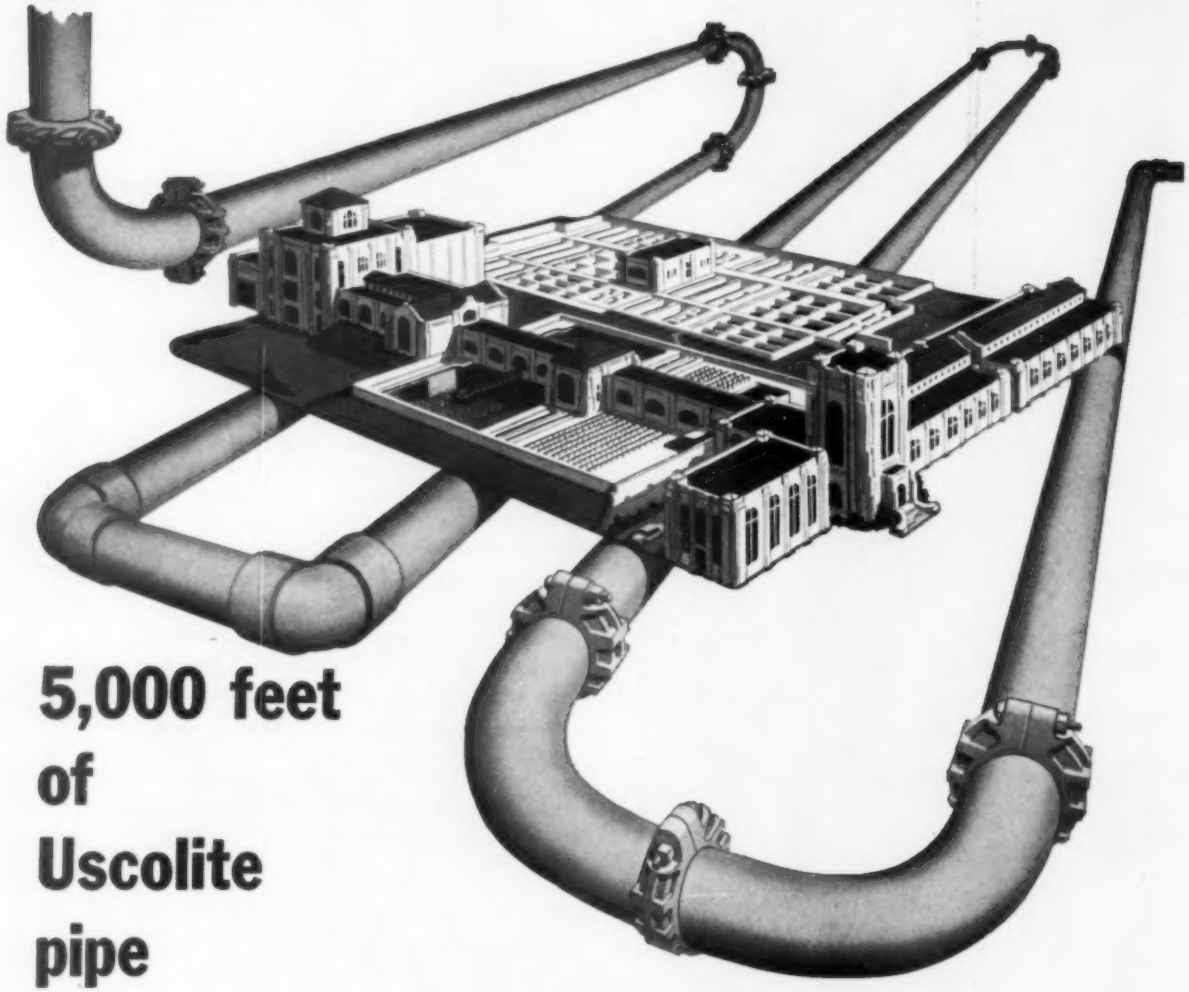

5,000 feet of Uscolite pipe

in the chlorination lines of Fort Wayne's new water-filtration plant

One of the most modern installations of its kind in the world is the new water-filtration plant of the Fort Wayne City Utilities. As part of its modernization program, it required an extensive system of new chlorine solution lines—lines that would be corrosion resistant and absolutely non-contaminating. So they chose Uscolite® plastic pipe—5,000 feet of it. It is used to carry chlorine solution and a phosphate solution.

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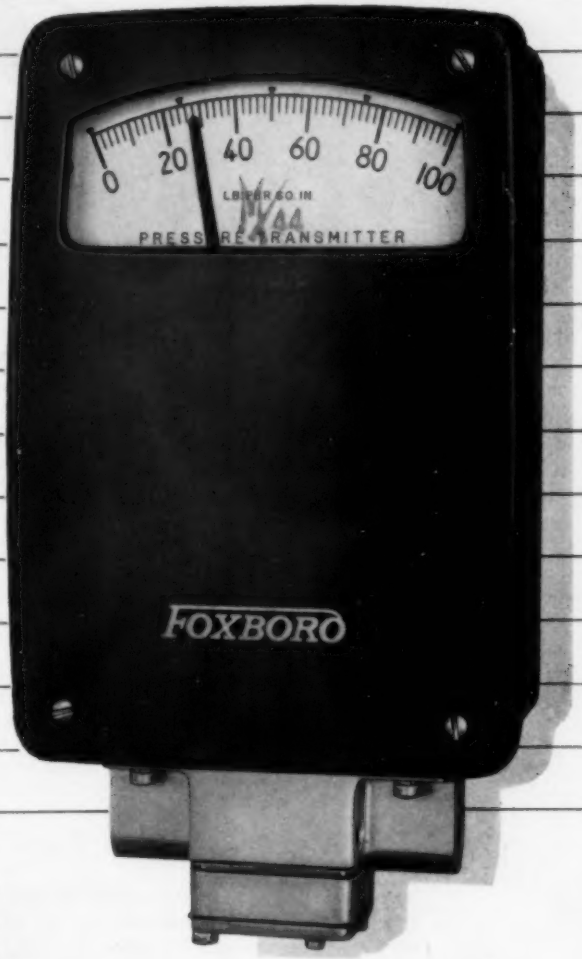

- **Easier to Read . . . large indicator scale, visible at 20 ft.**
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Any way you look at it, the new Foxboro M/44 Pneumatic Pressure Transmitter gives you an unmatched combination of fine engineering and economy. First; because it *is* an engineered instrument. There are no attachments or "makeshifts". Second; because it utilizes standard Foxboro parts throughout—parts which have been performance-proved in thousands of successful installations of other Foxboro Instruments. And this means not only top performance, but easier servicing and stocking as well. Third; calibration is simple, right in the field, because the M/44 is "convenience-designed" by men with years of experience in every phase of instrument design and application.

In appearance, too, the M/44 has unmistakable Foxboro quality. Features like the high-legibility indicator scale, the compact drawn-steel case with tough polyester plastic cover. It's the neat, high-efficiency, low-cost pressure transmitter for centralized operation or control. All standard ranges.

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INSTRUMENTATION FOR INDUSTRY

we need a better bucket!

Nature is lavish with rain. But careless of where she distributes it. Of every 20 raindrops that fall, only one is for us. The rest run out of reach into streams, rivers, percolate into the ground, evaporate. This is one reason why a quarter of our American population today faces actual water shortage or water of poor quality.

Since we cannot increase rainfall, let's make the most of what we have. You can help.

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Tomorrow's water supply depends on you *today*.

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First laid in Philadelphia in 1817 this cast iron water main... America's oldest . . is still on the job. This long life is typical of many more century and older cast iron mains still serving throughout the nation.

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AN UNINFORMED PUBLIC IS AN INDIFFERENT ONE

Most indifference is usually the result of lack of knowledge.

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That's why we run national advertisements* like the one opposite. Each one in the series reaches millions. Each brings out another phase of water supply important to *you.*

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pipe FOR MODERN WATER WORKS

shaves cost...

"THAT NEW **TYTON JOINT** SHORE IS EKKINOMIKAL...PAW BOUGHT A BRAND NEW TIRE WITH THE MONEY HE SAVED."

U.S. cast iron **PIPE** **FOR WATER, SEWERAGE AND**

saves time

More lengths laid per man hour...
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No bell holes. No weather worries... "Tyton Joint" can be laid in a wet trench or rain. And so easily even a green crew becomes expert quickly.

For more speed, simplicity, dependability in pipe laying—all along the line—get the facts on "Tyton Joint." Call or write today.

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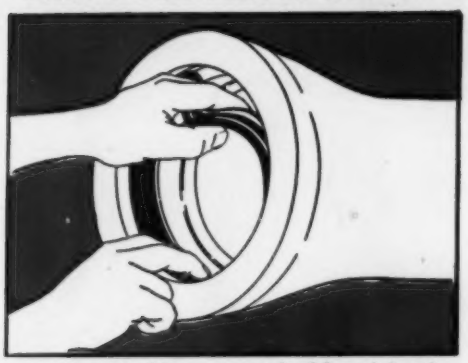
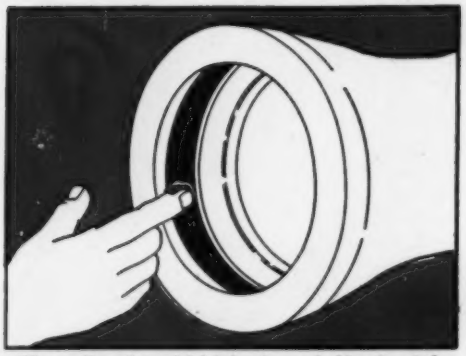
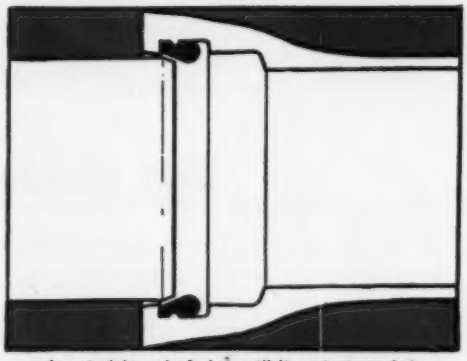


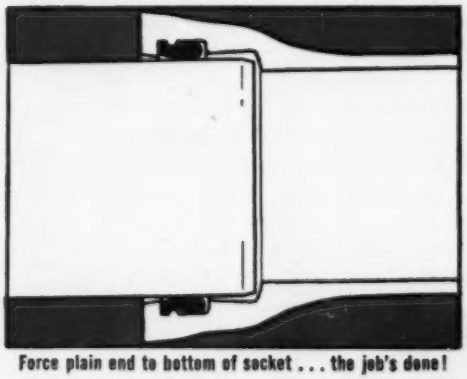
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

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He's a business man looking for a place to build a new plant . . . a plant that will bring prosperity and growth to the community he chooses. Water supply is one of the most vital questions, and many a golden opportunity has been lost by a community because its water system is inadequate.

In Plattsburgh, N. Y., the story was different. Wasteful habits were causing water shortages, so Plattsburgh decided to install water meters. As a result, they "found" 1,400,000 more gallons daily . . . enough to supply a new Strategic Air Command Base now located there.

Even communities who have had meters for many years . . . but have allowed them to run down . . . can "find" more water simply by repairing the meters.

These savings are *real*. The meters give a strong money incentive for conservation. They help keep wells and reservoirs from running dry. The same filter plants and water mains may serve up to twice as many customers . . . with lower daily operating costs.

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WATER & SEWAGE WORKS

VOL. 104, NO. 7 • A Scranton Gillette Publication • JULY, 1957

WALKING BEAM FLOCCULATORS atop the Brantford coagulation basin.

Flocculators of the Walking-Beam Type

What they have meant to us at Brantford, Ontario

by DON B. WILLIAMS

Mr. Williams is Chemist in Charge of Water Purification at Brantford, Ontario.

In this article, written specifically for publication in *Water & Sewage Works*, he understandingly recites his high regard for the Walking-Beam Flocculator, based upon recorded performance.

THE PURPOSE of this paper is to discuss the installation of a particular type of mechanical flocculation equipment in a "conventional horizontal flow" type of water treatment plant; to describe the equipment, to describe conditions leading to the installation of such equipment; and, to document results obtained.

Prior to 1931 Brantford derived its water supply from an infiltration gallery. Apparently for most of the time this system served quite well but there must have been times when the gallery supply was inadequate because provision was made, and used, to draw water from the neighboring hydraulic canal which connects to the river. Since, for the greater part of the year the river water is quite low in turbidity, the augmenting of the gallery supply with raw river water would have been of little concern in the matter of appearance of the water. At other times when the river was quite turbid, due to freshets, the augmenting of the gallery supply with unfiltered river water would have caused real concern. These conditions, plus the growth of the city, and increased pumpages and the fact that it was not considered feasible to extend the gallery system, finally resulted in the installation of a rapid sand filter plant opened to operation in 1931.

Initially, in 1931, the plant consisted of an intake well; one over-and-under baffle type mixing (or flocculating) chamber; two settling basins parallel, each having a length of 100′, width of 29′ and depth of 20′, all approximate figures; six rapid

BRANTFORD'S Filtration Plant as enlarged in 1953.

sand gravity filters, each having a nominal capacity of one million U. S. gals. per day at 2 U. S. gals. per sq. ft. per min.; a clear-well and a filtered water reservoir, the latter two items having a total capacity when full of just over one million U. S. gals. and just under one million Imperial gals.

At first the mixing chamber, settling basins and filters in this new plant did not have much to do because most of the raw water was still derived from the infiltration gallery system. At those times when the river and canal did become quite turbid luck would more often than not be with the plant, in that the ground water table would rise and thus the gallery system would deliver even more than the normal amount of clear water. Thus the new plant "got by" quite happily on a "standard dose" of 0.5 grains of Aluminum Sulfate per Imp. gal. (7.1 ppm) from 1931 to approximately 1945. Since it has been later shown that it is very rare to find occasions when an actual floc is formed in either gallery or river water at such a low dosage the author is forced to assume that this standard dose of 0.5 grains per Imp. gal. mostly remained in solution, doing little apparent good or harm.

Finally in the 1945-46 period, with pumpages increasing and the gallery system becoming less able to meet the demands, very turbid water was being withdrawn from the canal; and, with the above fixed low dosage of alum there were periods in which water of rather high turbidity was delivered to the consumer. During this period there was no chemist or even laboratory equipment at the plant, turbidities in the raw and finished water was not determined and the "standard" 0.5 grains of alum per Imp. gal. was rigidly adhered to, come what may. In 1947 a laboratory was built and the author was placed in charge of this laboratory and the chemical operation of the plant. Since Grand River water is not at any time an easy water to coagulate and, since during freshets it was difficult to make the plant turn out a clear water, the subject of more adequate coagulation was given immediate attention.

Using a Phipps & Bird Laboratory Stirrer on raw water samples, taken during clear and turbid periods as well as warm and cold water periods, the following answers to the coagulation problem were found:

(1) By far the best treatment, having regard to rapid floc formation, floc size and speed of settling, was the excess lime softening process, with and without soda ash.

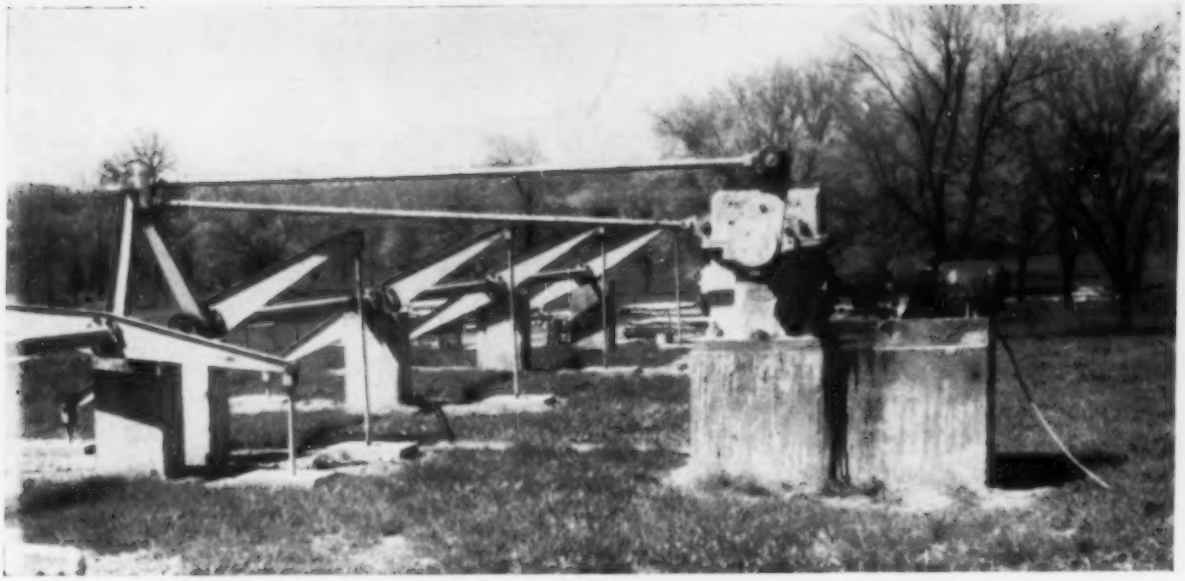
(2) Slight improvements to (1)could be made by additions of alum and/or activated silica.

(3) For normal clarification only, not involving softening, aluminum sulfate proved to be the best coagulant from all standpoints when compared with ferric chloride, ferric sulfate, ferrous sulfate, ferrous sulfate and lime, and ferrous sulfate and chlorine. Modifying the pH of the highly buffered raw water with either acids or alkalies prior to alum addition produced negligible improvement. Attempts to aid coagulation by additions of clays or calcium carbonate prior to alum were equally disappointing.

(4) Coagulation by means of aluminum sulfate could be remarkably improved by means of activated silica, added *before* the alum, the optimum dose of activated silica being found to be 5 ppm.

Since excess lime and soda softening, with its high operational costs, would necessitate high capital expenditures to put it into operation, this treatment procedure was ruled out and therefore we were left with normal clarification by means of aluminum sulfate only.

To the author the first few freshets in late 1947 and early 1948 were at once enlightening and disconcerting. For example; with very turbid water it was quite possible to produce satisfactory coagulation and settling with the laboratory stirrer at dosages of alum in the 2.5 to 3.5 grains per Imp. gal range, but such dosages used in plant operation would result in the water on top of the filters having the appearance of a mud-puddle and obviously such water did not filter well, resulting in turbid water going to the consumers. It was very apparent that there was some great difference between plant operation and the laboratory stirrer. Since all other conditions as to turbidity, pH, alum dose etc., were the same in plant water and laboratory samples, the obvious difference was that after the initial flash mix of the alum with the water the laboratory samples were being properly stirred for a suitable length of time, whereas such was not the case in the plant water. Briefly our under- and-over baffle for the purposes of flocculation was insufficient. In fact, the detention time in the baffled chamber was often less than 5 minutes at high flows, whereas the



DRIVE and walking-beams of the flocculator

laboratory work had shown a required stirring time of not less than 20 minutes for satisfactory flocculation.

Mechanical Flocculation Recommended

Mechanical flocculation was recommended but meanwhile it was necessary to operate the plant as it stood. Plant mechanical deficiences were overcome by "chemical shock treatment" in which we deliberately operated the plant in freshet periods with dosages of alum ranging from two to three, and even four, times greater than that indicated as sufficient by the laboratory stirrer. Generally this double and triple dosage of alum produced very good results as far as the clarity of the finished water was concerned, although there were admittedly some very bad periods. To do this successfully required very frequent sampling for turbidity of the raw water, water one hour out in the basins, on top of filters and filter effluents. Frankly the author often felt like some "Merlin" administering some black art rather than making a few simple scientific observations. Definitely we were "guesstimating" at high cost. The plant was expanded in 1953 to include one additional basin plus two additional filters, each having a "nominal" capacity of 1.5 Imp. M.G.D. but capable of delivering 3.0 Imp. M.G.D. if required.

The new basin at the inlet end was provided with four essentially square chambers for flocculation purposes in which revolving paddles were to be installed. In addition mechanical flocculators were to be installed in the old basins, but when the plant expansion of 1953 was complete all of these mechanical flocculation devices had been omitted. Thus we continued in our previous system of double or triple alum dosages up until Febraury 1947. Particularly changes in turbidity or rates of flow would upset even the best of our black magic and slight under or over dosing with alum would cause trouble. We had no operational margin.

Early in 1955, with pumpages ever increasing, it became very apparent that we had almost arrived at the point where mere overdosing with alum would no longer suffice, something must be done and we had good reason to believe that mechanical flocculation was the answer. The author drew the entire subject to the attention of his immediate superior, Mr. W. Secord. Asst. Mgr. who, after examining all the facts, gave ample support to our mechanical flocculation campaign. The "facts" include a lengthy memorandum on the past and present operation of the plant, numerous jar test demonstrations, and a large number of graphs in regard to jar tests showing the results of various alum dosages at various turbidities and various periods of stirring, plus a complete abstract on all papers dealing with flocculation and coagulation appearing since 1940 in "Water & Sewage Works", the Jour. of the American Water Works Association and Jour. of the Institution of Water Engineers, London. In addition we wrote to a number of other water works, as widely separated as London Eng. and St. Louis, Mo., outlining our problem as we saw it, and asking for opinions as to whether or not mechanical flocculation would help us. The answers were unanimously in favor of mechanical flocculation and one suggested that we contact Mr. W. G. Beazley, Prod. Mgr., Division of Water Supply, Norfolk, Va., who supplied us with a copy of a paper[1], not then published, dealing with a similar problem at his plant, which was overcome by the use of Stuart Walking Beam Flocculators.

We Purchase Mechanical Flocculators

Having been conditioned by seeing the horizontal type of underwater revolving paddle flocculators operating in other plants we now blush at admitting that we were not too impressed by the photographs of the Walking Beam Flocculators at Norfolk. To us they appeared too complicated. However, we did arrange, with no obligation to us, to have Mr. Fred E. Stuart Jr. of the Stuart Corp., Baltimore, visit our plant to review facts and if possible make a proposal. Our question to him was essentially: "If our settling basins were a mile long it would do no good because very little settling would take place due to poor floc formation, but if we stole some of our settling basin space for flocculation purposes we would at least form a floc which in even a shorter basin would settle to some extent and at worse a floc coming on to filters is better than an alum fog, After seeing some floc tests, the condition of the plant water, plus

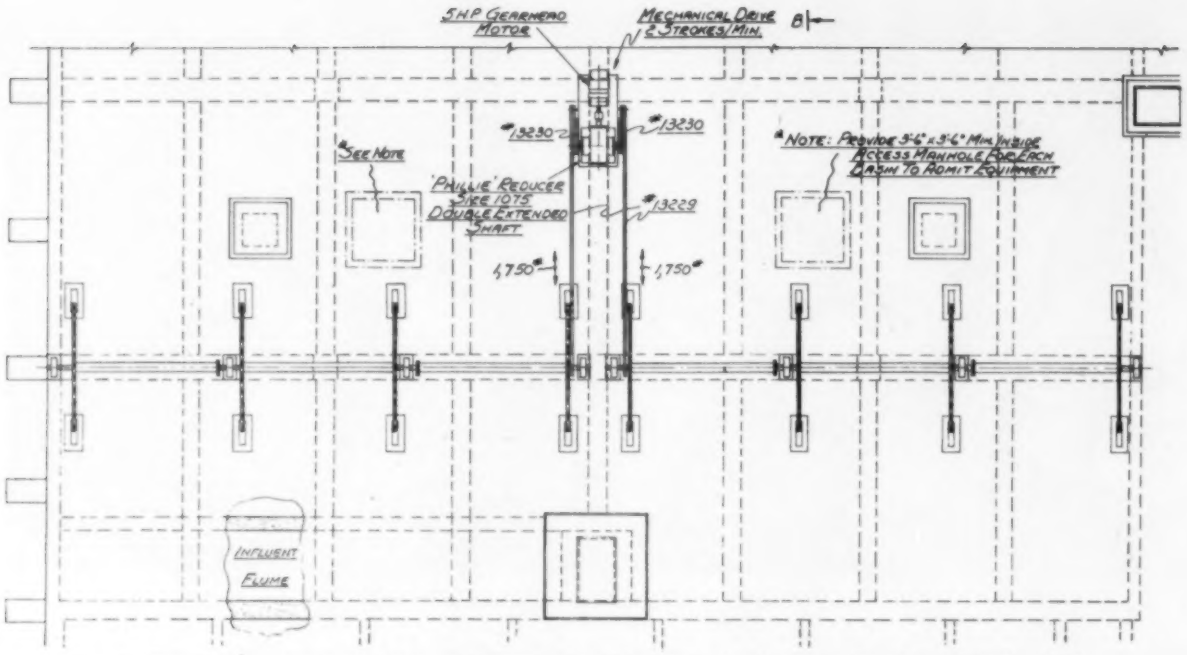


Fig. 1—The 5 HP motor gear drive and flocculator shafts shown in plan atop the old coagulation basin.

examining much physical data in regard to the plant, it was his opinion that we could "steal" enough basin space to give 20 minutes flocculation minimum at high flows and 30 minutes maximum at low flows, still obtain the required settling in shorter basins, obtain a real floc, turn out a clearer water at a reduced alum dose. Later we received a proposal complete with working drawings which, after careful review, resulted in us purchasing the equipment for the two old basins only. Most of our period of troublesome turbidity occur in winter periods of lower pumpage and since the new basin posed a construction problem, to be discussed later, we felt justified in trying out the equipment on the old basins only and cutting off the operation of the new basin during freshets. The equipment was ready to operate in mid February but the river was very clear and thus we had to wait for a freshet for proper evaluation.

Finally, came February 26, 1957, plenty of snow on the watershed, air temperature up to 60°F plus a copious warm rain. By midnight the turbidity went up to 45 ppm and a jar test indicated a dosage of 3 grains of alum. Normally we would have doubled this figure for the plant run to 6 grains, but to try out the flocculators instructions were left to operate at 3 grains, same as the jar test, and to call the author during the night if the operation was not successful. The author might just as well have stayed at the plant because he did not sleep and could not understand the lack of a phone call—either the flocculators were a complete success or a rank failure. First glance at the tops of the filters next morning told the story. The water on top of the filters was so clear that you could see the sand and the operating staff were wandering up and down the filter deck first looking at the water and then looking out at the new flocculators. None of us could believe that we were operating successfully at 3 grains when normally we would have used 6 grains. Even 3 grains was too much and thus we were able to finish out the day at 2 grains of alum, instead of 6!

Those who are accustomed to turbidities of over 1,000 ppm which generally have a coarse type of particle may laugh at our much lower raw water turbidities in the range of 10 to 100 ppm, but these lower turbidities experienced by us are of a colloidal clay—like nature and in our cold water periods is very difficult to floc. We have never had too much trouble with "coarse" turbidity in excess of 500 ppm, it has always been the lower turbidities at the beginning or end of a freshet that has caused us trouble.

For those who wish to see figures the following "before and after" figures are given:

TURBIDITY AS PARTS PER MILLION

	Dec 8/56 flocculators not installed	Feb. 27/57 flocculators operating
Intake Well	48.0	.... 48.0
One hour out in basins	35.0	.... 11.0
Top of filters	12.0	.... 2.75
Filter Effluents	4.20	.... 0.15
	Above at 6 grains alum and all three settling basins in operation.	Above at 3 grains alum and only the two old basins operating.

Change in rate of pumpage used to be very troublesome but on Feb 27, 1957 we were able to show that the flocculators smoothed out this problem. A change of pumpage between 7 and 8 am. would always show up adversely on top of the filters during the period 10 am to 4 pm. Cutting the alum dose to 2 grains (instead of 6 grains) and having the flocculators operating, with only the old basins operating, the figures in the left column show that changing rate of pumpage did not adversely affect the results as to turbidity. The figures at the right are what, from our actual records, we would normally find from increasing rate of pumpage:

TURBIDITY AS PARTS PER MILLION

	From previous records	11.50 am. Feb 27/57
Intake Well	50	..... 50.0
One hour out in basins	50	..... 6.0
Top of Filters ...	20 to 35	..... 3.7
Filter Effluents ..	5 to 15	..... 0.1
	Above at 6 grains no flocculators all 3 basins on.	Above at 2 grains Flocculators 2 basins only.

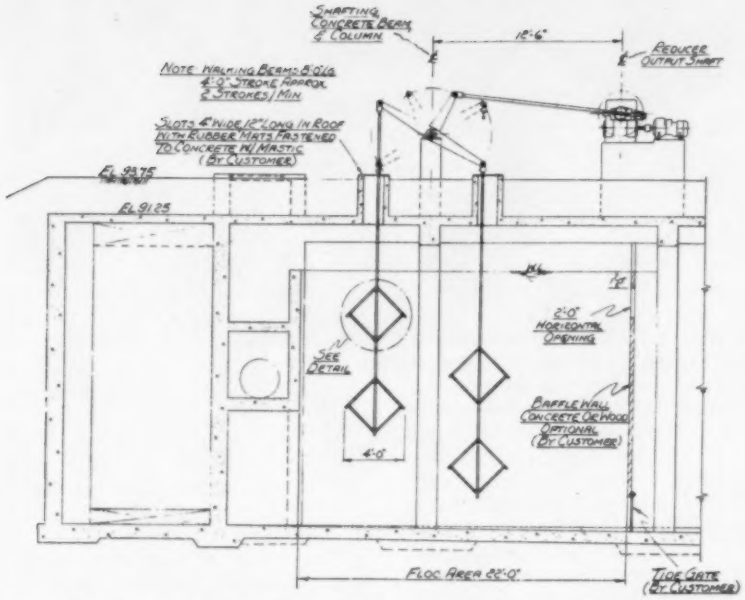

SHAFTING CONCRETE BEAM & COLUMN
12'-6"
REDUCER OUTPUT SHAFT
NOTE: WALKING BEAMS: 8 0/0 4'-0" STROKE APPROX. 5 STROKES/MIN
SLOTS 4" WIDE/12" LONG IN ROOF WITH RUBBER MATS FASTENED TO CONCRETE W/MASTIC (BY CUSTOMER)
EL. 93.75
EL. 91.25
2'-0" HORIZONTAL OPENING
SEE DETAIL
BAFFLE WALL CONCRETE OR WOOD OPTIONAL (BY CUSTOMER)
4'-0"
FLOC AREA 22'-0"
TIDE GATE (BY CUSTOMER)

Fig. 2—Sectional view of the above and below water units comprising the flocculator.

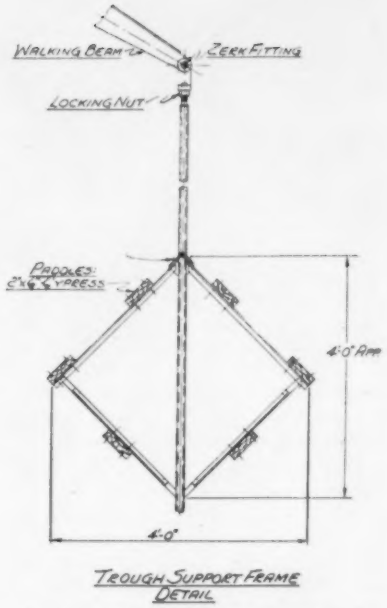


Fig. 3—Detailed section through one of the flocculating elements that travel up and down to produce gentle flocculation.

The flocculators also absorb to a large extent an increase in turbidity. On Feb 27/57 we operated quite successfully at 2 grains alum on a raw water turbidity of 50 ppm up to 5 pm and the author went home. On returning to the plant at 10:30 pm he found that the raw water turbidity had risen to 80 ppm and a jar test showed that 3 grains of alum per Imp. gal. was required (we would normally be using 6 grains) and that the 2 grains per gal. was now inadequate, *but* the flocculators had absorbed the punch and conditions were by no means out of hand. The left column shows figures found on this occasion and the right hand column shows figures, based on our records, of what such a change in turbidity would have done:

Turbidity as Parts Per Million			
Intake Well	80	....	80.0
One hour out in basins	75 to 80	....	15.5
Top of Filters	30 to 40	....	14.5
Filter Effluents ..	8 to 20	....	1.25
	Above at 6 grains, all 3 basins operating, no flocculators.		Above at 2 grains when 3 grains required, two old basins only, flocculators operating.

Since Feb 27/57, and up to the time of writing, we have had several spring freshets all lasting approximately one week and thus we have had ample opportunity to record even more figures attesting to the unqualified success of this equipment and since the figures are relatively identical with those shown above there is no point in a boring repetition of mere figures. However two outstanding occurrences are worth relating: On Sat., April 6/57, with relatively low pumpage, we were operating quite successfully at 1.5 grains of alum per Imp. gal (instead of 4 to 6 grains) on a water having a turbidity of 55 ppm at 10:30 pm. During the night the raw water turbidity increased to 130 ppm and was at that figure the following morning when the author arrived. The operator had not increased the alum dose "—because the flocculators are doing a good job and the water on and through the filters is clear." A jar test showed that 2.5 grains per Imp. gal. was required but we had "got by" with 1.5 grains and the turbidity of the filter effluents was still only 0.50 ppm. Normally we would have had a mess on our hands at between 4 and 6 grains of alum per Imp. gal. On another occasion when the river water was quite clear we drained one of the old basins to see how much sludge was accumulating and to check over our new equipment. Almost immediately a quirk of nature gave us a turbid river. We could not get the old basin back into operation for several days because of some valve and piping trouble. We had to shut off the new basin since it contained no flocculators and thus we rode out the freshet with only one set of flocculators in one old basin, one third of our normal settling capacity. Results were still very good, better in fact than in previous freshets with all three basins in operation and no flocculating equipment installed.

The author has purposely dwelt at length on the above figures and details because when we were making enquiries in regard to this entire subject the replies were generally lacking such detail and therefore it is hoped that the above information will prove to be a guide to others. All turbidity determinations were made with a Hellige Turbidimeter, an instrument that we find very suited to making large numbers of determinations in a short time.

A Testimonial

The author has no financial interest in or any connection with the Stuart Corp. who supplied the flocculators, but takes the attitude that here we have been provided with an excellent and relatively inexpensive tool—a money saving tool—for the purpose of overcoming the contentious problem of flocculation in a water plant previously ill-equipped in that regard. In addition this tool permits us to produce a superior product as to clarity. It is on the above basis that the author has prepared this paper for the benefit of others who may be groping in the dark as we were. The author cannot resist the temptation of reproducing here his memorandum to our management on the success of this particular installation:

"The purpose of this memorandum

is to outline the very successful experience with the use of mechanical flocculation equipment during the recent freshet.

The freshet started to take place at 11:00 pm, Feb 25/57, the turbidity in the raw water rising to 45 ppm. Lab floc tests showed that with this turbidity and with the use of our new flocculators we should be able to operate at 3 grains alum per Imp. gal. The flocculators were put into operation, the new basin not containing flocculators was turned off. The alum dosage was set at 3 grains and the writer left after midnight leaving instructions to be called if conditions as to coagulation and filtration were not satisfactory throughout the night.

The writer was not called during the night and the reason was very apparent next morning: conditions on top of and through the filters were the best that the writer or the operator have ever seen during freshet period.

Thus on this first night we ran successfully at 3 grains alum when we have previously established that without flocculators we would have had to use 6 grains of alum. Thus a 50 percent saving of alum is apparent.

The following day, Feb 27/57 from 9:00 am to 5:00 pm the writer recorded varying turbidities in the raw water ranging from 45 to 53 ppm. The nature of the raw water, as to ability to be flocculated, had changed slightly and, a floc test showed that we should be able to operate at 2 grains. We operated all day at 2 grains with very successful results.

Therefore, on this first full daytime operation we ran successfully at 2 grains when the writer knows full well that without the flocculators we would have had to run at 5 grains. Thus, a 60 percent saving of alum is apparent.

During this first full day operation the turbidity of the water coming on top of the filters was in the range 2.75 to 4.00 ppm. Without flocculators we would have had turbidities ranging from 7.0 to 20.0 ppm and even 30.0 ppm. More important, the water passing through the filters was in the turbidity range 0.05 to 0.25 ppm; whereas, without flocculators we would have had figures ranging all the way from 0.50 to 4.00 ppm, and even higher, and would have been hard pressed to obtain such results. Anything greater than 0.75 ppm effluent turbidity is not looked upon with favor by the writer.

Finally at 10:30 pm, Feb 27/57 the turbidity rose sharply from 45 to 80 ppm in the raw water. The operator called the writer to inform him of this sudden change and the writer in turn told the operator to go up to 3 grains until the writer had time to go to the plant to make a floc test. This floc test was made and resulted in continuing at 3 grains of alum all night successfully; whereas, normally without flocculators we would have had to use 6 grains, an apparent 50 percent saving of alum. At the time that this sudden increase in turbidity became apparent a fairly large amount of the higher turbidity water would have passed through our mixing and flocculating area prior to the writer being called to make the test. It is important to note the fact that the flocculators being in operation during this period, permitted the plant to absorb the high turbidity shock and therefore the turbidity on top of the filters only went up to 14.5 ppm when we would normally without flocculators have found a turbidity of 40 ppm; and, more important, the water passing through the filters only increased to 1.25 ppm. Without flocculators we would have normally experienced figures from 3.0 to 10.0 ppm and even up to 20.0 ppm turbidity in the effluent.

These flocculators, therefore, apparently absorb the shock of the onset of high turbidity.

The next day, Feb 28/57 we were able to cut the dosage of alum to 2 grains when normally without flocculators we would have had to operate all day at 5 grains, an apparent savings of 60 percent in alum. Further the results with 2 grains and the flocculators were superior to 5 grains and no flocculators.

Another point of real interest is that on these two days when the filtering load was increased at the beginning of the day we did not experience the sudden increase in turbidity on top and through the filters that we normally have found prior to the use of flocculators. As far as the load increase was concerned on these two days virtually nothing happened. Thus, this new equipment absorbs the shock of filter load increase.

On Mar 1/57 the turbidity in the raw water being down we were able to reduce the alum dose to 1.5 grains but without flocculators we would have had to use at least 3. grains, an apparent 50 per cent saving of alum.

Finally on Mar 2 & 3/57 with raw water turbidity much more reduced we were able to show from floc tests that we must run at 1.5 grains of alum when without flocculators we would have run some 2.0 to 2.5 grains, an apparent 27 per cent alum saving.

Therefore, at varying raw water turbidities, and varying rates of flow we have during a freshet seen savings in alum of from 25 to 60 per cent, with a saving of 50 per cent being in evidence for the greater part of the time, and all this with better control of operation and a clearer effluent.

It is to be realized that during this period it was necessary to shut off our new basin since it contains no flocculating equipment and thus the success of the flocculating equipment was experienced with one third of our normal settling capacity out of service.

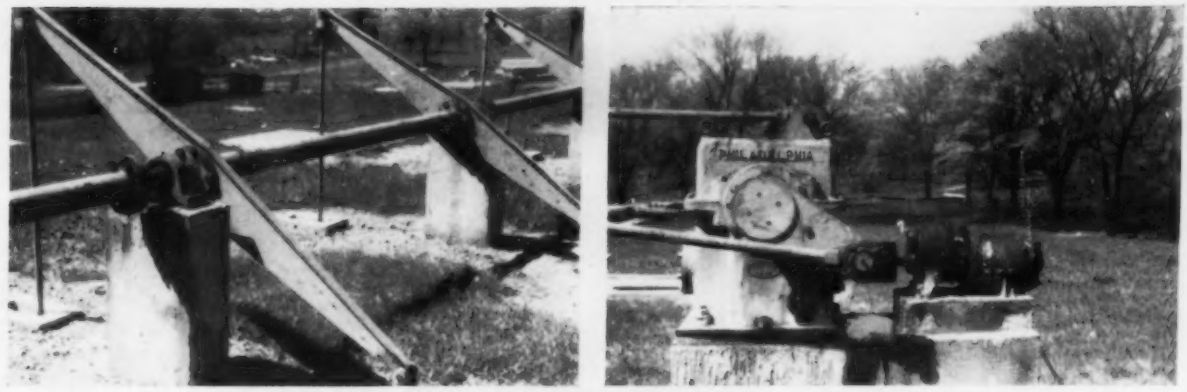
Therefore on the basis of these observations during this one freshet the writer states: Our new walking-beam type of flocculating equipment, provided by the Stuart Corp. of Baltimore, Md. was eminently successful, and exceeded our expectations in that it not only reduced alum dosages but also absorbed the shocks of changing turbidities and changing filtering loads and permitted us to turn out a much clearer water than is normal during freshet periods. This equipment in the opinion of the writer is money very well spent not only because it will give savings in alum but also because we were approaching the time when the turning out of clear water during freshets was becoming more difficult, it not impossible. The writer is therefore in full accord with installing this or similar equipment in our new basin and any other conventional type basins that we may build at any time in the future."

A Recommendation

So much for the report to our management: The author would go further than the above report in suggesting that if he were at any time associated with the design of a new horizontal flow type of plant or the rehabilitation of an existing plant he would strongly urge the inclusion of the walking-beam type flocculators in such works.

We have no quarrel with vertical or horizontal revolving paddles which are used with apparent success at other plants. The walking-beam type flocculators appealed to us because of low cost of the equipment, low cost of installation and associated construction, plus the fact that with all working parts out of the water the maintenance would be negligible.

The author refrains from discussing the total cost of this equipment at Brantford, because to do so would be misleading. For example, all the working equipment (the "hard-



CLOSE RANGE views of walking beams and motor-gear drive.

ware") had to cross the International Border, thus we paid duty. However, since the equipment was used in production of water we were excused from payment of the sales tax. Our own men made the actual installation. A local contractor did all necessary cement work, including the erection of two concrete block baffle walls, but had we been less pressed with other construction we would have normally done this work ourselves. The drive mechanism is mounted on a concrete slab setting squarely over the dividing wall between the two basins but in some plants more extensive support would be required. Since our basins are covered with reinforced concrete slab roofs over which there is some 2.5′ of earth it was necessary for the contractor to strip back the earth and to cut a number of 4″ x 16″ slots in the roof slabs. We specified that our flocculators have cypress paddles rather than steel. The buoyancy of the cypress required us to cast and install concrete billets to overcome the buoyancy. All of the above details varying from plant to plant make it impossible to translate Brantford figures into costs elsewhere. Suffice it to say that the total cost was less than half of what the author had expected and we believe that the entire job will have paid for itself in alum savings in 18 months to 3 years.

What is a Walking-Beam Flocculator?

What is a walking-beam flocculator and what does it look like?

The entire equipment may be described as follows: A "drive mechanism" (see Figs. 1 and 2) actuated by a 5 H. P. motor causes two long drive rods to move back and forth at two strokes per minute. The drive rods are connected to levers which in turn are fastened to a centre shaft and thus the strokes of the rods cause the centre shaft to rotate part of a circle and then to return. Fixed at intervals on the centre shaft are the "walking beams" (see Fig. 2) and therefore the partial rotation and return of the centre shaft causes the walking beams to tip up and down in the manner of a child's see-saw. Suspended from the ends of the walking beams by steel rods are the actual flocculators (see Figs. 1 and 2). The movement of the walking beams causes the flocculators to move up and down in the water in the manner of the "dollies" in some old fashioned washing machines or butter churns.

The flocculators being suspended each on opposite ends of the walking beam, are constantly passing each other in opposite up and down directions. Therefore, it is the large surface area presented plus the slow up and down motion of the pairs of flocculators moving in opposite directions that provides the gentle but constant swirling of the water so necessary to proper flocculation.

As to maintenance, there is very little to do. It is a manufacturer's requirement that the oil be changed in the drive mechanism after an initial number of hours run but after this initial oil change it will be only at very long intervals that an oil change will be necessary. The 5 hp motor is totally enclosed and is resistant to all weathers. Our operating staff faithfully inspects the equipment several times per day but they never have anything to do or report. The ends of the walking beams are provided with Zerk fittings so presumably the occasional application of a grease gun will be required. The entire equipment is virtually noiseless. Other than an occasional coat of paint, that is about all there is to say.

The New Basin

As stated above, the new basin constructed in 1953 was supplied with four almost square flocculation chambers. The inlet and outlet piping of these chambers was arranged to give a spiral flow to the water. In addition vertical type revolving paddles were designed for these chambers but were not installed. The Stuart Corporation proposed walking beam flocculators to fit into the area occupied by these chambers and from an engineering standpoint there is no apparent criticism of their proposal. We are temporarily holding up the work on the new basin since the proposal requires the removal of three concrete walls existing between the chambers and the reason for the hold up is our experience in phenominal costs of removing existing reinforced concrete in our locality. Currently, the Stuart Corporation is reconsidering these chambers with the thought of redesign of the flocculators that hang from the walking beams so as to obviate removal of existing concrete.

When is Mechanical Flocculation Justified?

A number of readers may ask how they can tell if their flocculation procedure is inadequate, if installation of mechanical flocculation is indicated at their plant. There are no hard and fast answers to such questions, but the author would suggest investigating the matter in the following manner:

(1) During a period of high turbidity when the plant is having difficulty turning out a suitably clear water, run a series of jar tests with the laboratory stirrer using the same coagulant as used in plant operation. The author uses 1,500 ml. beakers, 1,000 ml. samples of water and increments of 0.5 grains of coagulant per gallon for this work. Give a "flash" mix at 80 ppm for two minutes. Continue stirring at 30 rpm for a total stirring time of fifteen minutes. This is a "primary" crude jar test. At the end of fifteen minutes stop the stirrer and visually examine the samples in the jar for floc formation and speed of set-

tling, selecting the lowest dosage that gives satisfactory results. In a series running from 0.5 grains to 3 grains (6 jars) let us assume that we have found satisfactory results at 2.5 grains.

(2) Now starting with fresh samples run a "secondary" jar test but this time give all jars exactly the same dosage but vary the length of stirring time. On our first crude run we were satisfied with 2.5 coagulant at 15 mins. It was just good enough, so on this second test we purposely pick a "starvation" dose of only 2.0 grains. Apply this 2 grains to all beakers, give the initial flash mix of 2 mins. to all six jars, but on reducing the stirring to 30 rpm start taking the jars out of operation at 5 minute intervals. Repeating this experiment many times, with variations, showed us that a minimum of 20 minutes stirring was required on our raw water but also showed that no additional benefits accrued by lengthening the stirring period beyond 30 mins. (These figures are not expected to apply in every instance elsewhere). From this let us assume that you find an optimum stirring time of 25 mins., then stick to this stirring time and make a third jar test series in 0.5 grain increments.

Now let us assume that you find 2 grains of coagulant at 25 mins. giving you the type of results that you desire, then:

(a) On the same raw water if your plant requires greater dosages of coagulant than found in this third jar test, to turn out a satisfactory product, (for example 4 or 5 grains of coagulant instead of 2 grains found in the test) then unquestionably your plant requires mechanical flocculation and on a dollar and quality basis you can not afford to be without it.

(b) If your plant is operating at exactly the same dosage as the jar test but is not turning out a clear water and the floc in the basins and coming over to the filters is not as good as found in the test beakers then you also require mechanical flocculation.

(c) If you are unable, usually from experience, to use a dosage greater than that in a jar test so as to overcome plant mechanical deficiencies, because in so doing an alum "fog" (partly flocced alum) will come over on top of your filters, then here is another indication that mechanical flocculation is required.

(d) Naturally, if the results found in plant operation and in the laboratory stirrer are equally unsatisfactory then you are not using the coagulant most suited to your raw water; or, if you are, then a coagulant aid such as activated silica is required. Obviously this detail must be determined before considering any of the points above.

No Magic Involved

There is no magic involved in suitable mechanical flocculation. If with any particular coagulant you can obtain satisfactory results in jar tests; then, with suitable mechanical flocculation you can expect to duplicate or at least approach such results in plant operation. If in jar tests all coagulants, with or without coagulant aids, give unsatisfactory results then mechanical flocculation will give equally unsatisfactory results, but at least the results will be as good as those obtained in the jar tests. One must realize that the laboratory stirrer when properly used is a highly efficient device for causing flocculation in the presence of a suitable coagulant and there is no attempt on the part of manufacturers of mechanical flocculation equipment to indicate that their equipment will better the jar test results, rather their attempt is to duplicate or at least approach jar test results.

Some plants may, like ours, be able to reduce coagulant dose by 50 per cent—others more, still others—less, and further there may be some plants in which no savings in coagulant will be made but water quality will be vastly improved and filter runs lengthened. For this reason the author harps on the necessity of jar test investigations plus having any mechanical flocculation equipment engineered to suit *your* plant and raw water.

VIEW DOWN the twin flocculator shafts, showing rod "chimneys" through basin cover.

Re. Alum Savings

In regard to alum savings, a word of caution is offered in evaluating such equipment by merely checking alum savings at the end of each year on the basis of tonnage bought and used. Even with flocculators there will be some years when our total alum tonnage can be higher than previous years without flocculators and on consideration this can come from long periods of floods or freshets, when normally throughout the year floods and freshets represent only a part of total operation. For example the period Nov. 1952 through to early June 1953 was an almost constant period of high turbidity due to rains and an "open" winter and during this period we used much more alum than in any previous similar period. The use of flocculators would not have eliminated this long period of high alum dose, for the simple reason that flocculators cannot stop freshets, but they would have on the average reduced the alum dose by 50 per cent. Another example is the month of Nov. 1955 in which turbidity through almost an entire month necessitated the use of 68,000 lbs. of alum, a previously unheard of figure for the normally clear raw water month of November. Here again the flocculators would not have cut the alum dose to the level generally used in clear November waters but would have roughly halved that used. Therefore the flocculators must be considered as making a saving on a per day to day basic dependent on conditions and in considering any savings at the end of the year the number of floods, and freshets and the resultant turbidities must be taken into consideration.

With the above in mind and taking into consideration the "flashy" nature of our river we appreciate that our alum savings are "hidden savings", even so they are just as real because now during periods of high turbidity we no longer think and operate in terms of 4 to 8 grains of alum per gallon but rather find 1.5 to 3.0 grains to adequately suffice.

With no savings at all we would still be quite happy about our new flocculators on a quality control basis and never again would this author want to operate a conventional horizontal type plant on a flashy stream without the use of mechanical flocculation.

Reference

(1) "Water Treatment at Norfolk, Va." by S. M. Hodges and W. G. Beazley, page 415, "Water and Sewage Works," Volume 102, #11, Oct. 1955.

2nd Installment

Report on 77th AWWA Convention

Atlantic City meeting draws record attendance of 3067

IN THE PREVIOUS issue of *Water & Sewage Works,* we reported on the new Association officers and the recipients of the awards for 1957. In this issue, we shall report on the division officers, the manufacturers association and several technical sessions.

Record Registration

True to predictions, this meeting broke all records for attendance. The following tabulation shows the registration for the last four meetings.

Year	1954	1955	1956	1957
Place	Seattle	Chicago	St. Louis	Atlantic City
Water Works Personnel, etc.	901	1167	1154	1378
Equip. Mfrs. Repr.	635	908	874	1020
Ladies	527	512	510	669
Total	2063	2587	2538	3067

Division Officers

All four divisions elected new officers for the ensuing year.

Purification Division

Chairman—Paul D. Haney, Cons. Engr, Black & Veatch, Kansas City, Mo.

Vice Chair.—J. M. Jester, Engr., Maint. & Oper., Washington Suburban Sanitary Dist., Hyattsville, Md.

Secretary—Chas. A. Black, Pres., Black Labs., Gainesville, Fla.

Trustees—H. E. Hudson, Detroit Mich., and J. M. Sanchis, Los Angeles, Calif.

Distribution Division

Chairman—E. J. Allen, Asst. Supt. Water Dept., Seattle, Wash.

Vice Chair.—J. B. Ramsey, Chief Engr. and Supt., Water Dept., Kansas City, Mo.

Secretary—B. E. Payne, Chief Engr. and Supt., Louisville Water, Co., Louisville, Ky.

Trustees—H. J. Graeser, Dallas, Tex. and J. G. Carns, Philadelphia, Pa.

Management Division

Chairman—V. A. Appleyard, Chief of Water Operations, Philadelphia, Pa.

Vice Chair.—Wm. D. Hurst, Chair. of Comm., Greater Winnipeg Water & San. Dist., Winnipeg, Man., Can.

Secretary—J. J. Garland, Div. Mgr, Amer. Wat. Wks. Service Co., Richmond, Va.

Trustees—Wm. R. Seeger, San San Rapheal, Calif. and Gerald Remus, Detroit, Mich.

Water Resources Division

Chairman—Chas. H. Bechert, Director, Indiana Dept. of Conservation, Indianapolis.

Vice Chair.—J. W. Cramer, Cons. Engr., Lincoln, Neb.

Secretary—A. R. Davis, Dir., Water & Sewer Dept., Austin, Tex.

Trustees—Roy W. Morse, Seattle, Wash., and Lynn M. Miller, Lansing, Mich.

Manufacturers Association

The annual luncheon of the Water & Sewage Works Manufacturers Assn. was addressed by Hon. John A. Blatnik, Congressman from Minnesota, who is chairman of the House Public Works Committee's River and Harbors Subcommittee. It was Congressman Blatnik who sponored provision in P.L. 660 which provides $50,000,000 a year for ten years as grants to cities for construction of sewage treatment facilities. In his talk Congressman Blatnik reviewed the reasoning behind this provision and the importance of water pollution control to adequate water supply.

Following the luncheon, new members were elected to the Board of Governors of the Manufacturers Association. The five new members are:

Geo. W. Kelsey, B-I-F Industries, Inc., Providence, R. I.

R. V. Edwards, American Pipe and Construction Co., Los Angeles, Calif.

E. M. Jones, Simplex Valve & Meter Co., Lancaster, Penna.

J. F. O'Grady, National Meter Div., Rockwell Mfg. Co., Pittsburgh, Penna.

T. T. Quigley, Wallace & Tiernan, Inc., Belleville, N. J.

At the Board of Govenors meeting, the following persons were elected to take office on Jan. 1, 1958.

President—Richard V. Ford, Ford Meter Box Co., Philadelphia, Pa.

Vice Pres.—E. E. Alt, Chicago Bridge and Iron Co., Chicago, Ill.

Treasurer—R. F. Hayes, Hydrotite Co., New York, N. Y.

Manager—John G. Stewart, New York City.

Secretary—Dorthy E. Dimmers, New York City.

Water Resources Div. Sessions

The Water Resources Division held three sessions and one General Session was devoted to Water Resources Policy and Development.

Land Acquisition Policy

Francis S. Friel, Cons. Engr., Philadelphia, Penna, presented an illustrated talk on LAND ACQUISITION POLICY FOR IMPOUNDING RESERVOIRS. In his paper, Mr. Friel brought out the lack of uniformity of practice in the various states. The problem divides into these categories: Areas, purposes of acquisition and policies of acquisition.

For the purpose of discussing land acquisition policies, it is possible to classify lands into three categories: The reservoir area, itself, including lands necessary to construct the dam and other appurtenenat structures; the marginal strip immediately around the periphery of the flooded area at normal and maximum high water level; and the drainage or watershed area above the reservoir.

The purposes of land acquisition are related to the different areas to be acquired and involve such factors as clearing the flooded area, preservation of quality of water supply, silting prevention, access, protective

planting, and to avoid liability for property damage.

Mr. Friel cited several examples to illustrate the wide variations in the policy of land acquisition. These variations stem from local situations and differences in uses of the reservoirs. Where hydroelectric development, flood control, irrigation, or recreation are involved in reservoir use, policies of land acquistion will be expected to differ from the situation where water supply alone is involved.

Several examples cited had land areas acquired equal to 2.8 to 3.0 times the area of the reservoir itself. Many policies cited based the amount of land acquired as marginal land around the reservoir on the high water elevation; some purchasing land up to 10 feet above the flood elevation, others up to 20 feet. In some instances the "take" is based on either a horizontal distance from the reservior line or a vertical distance above flood level, whichever is greater.

A survey of state regulations regarding the matter, showed that two states have regulations, 11 states have no regulations but make recommendations, and 37 states neither make recommendation nor have any regulations.

Mr. Friel's paper was discussed by E. Sherman Chase, partner, Metcalf & Eddy, Cons. Engrs., Boston, Mass., and by H. J. Graeser, Supt., Water Dept., Dallas, Tex. Mr. Chase referred particularly to practice in New England, which is exemplified by Boston's Quabbin Reservoir, where 68 per cent of the total watershed is owned by the water works. This practice of large area ownership stemmed from the development of water supply reservoirs before the days of chlorination. Mr. Chase also commented on the planting of trees around the reservoir sites, pointing out that evergreens had about half the foliage of deciduous trees and that dropped needles were far less inclined to be blown into the reservoir; as a result better water supplies are obtained.

Mr. Greaser spoke in reference to situations in Texas where drainage areas may run up to 2500 square miles or more and where there is always the problem of municipal sewage pollution on the watershed areas. He cited instances where the practice has been to buy 9½ feet of land above the water level, on the theory that flood levels would be up to five feet and wave action 4½ ft higher. In many instances the horizontal distance acquired was only 30 ft.

Public Access to Reservoir Lands

The subject of PUBLIC ACCESS TO LANDS SURROUNDING IMPOUNDING RESERVOIRS was presented by Daniel P. Morse, Vice Pres. & Gen. Mgr., Indianapolis Water Co., Indianapolis, Ind. and was discussed by E. J. Allen, Asst. Supt., Water Dept., Seattle, Wash., and by J. W. McFarland, Gen. Mgr., East Bay Muni. Util. Dist., Oakland, Calif.

In Indianapolis, the creation of two reservoirs for water supply, also created a demand by the public for access to the reservoirs for recreational purposes. This was to be expected since there are no natural lake areas in that part of the state. Mr. Morse described the need for and the policy adopted in building these reservoirs, which are for the sole purpose of providing regulation of water supply on two relatively small streams. One is 16 miles, the other 25 miles from the filtration plant. All water from both reservoirs passes through the complete purification process.

The first reservoir, created some years ago was finally opened to public access under a strict policy that allowed fishing, but no hunting. A commercial boat house, dock and facilities was built under a lease and concession. One area of reservoir land was set aside for picnics, another was leased to a sailing club, which built its own club house and facilities. The water company issues licences for boating, and lets the public know that the public is the guest of the water company. No cottages are permitted.

The second reservoir also has a boating concession for fishing purposes, with the boats limited to outboard motors. Also at the second reservoir, the more distant one, a power boat club has been allowed to construct a club house and docks. The power boats are restricted as to areas in which they can operate. Mr. Morse said that the most important factor in working out such arrangements was to find responsible people to run the concessions. In the case of Indianapolis this has been done.

Mr. Allen pointed out that in the mountainous areas of his part of the country, the matter of access was different. There is little pollution of watershed areas. Logging is allowed, but modern methods of logging do not create pollution problems. There are plenty of lakes and streams in the area for persons who want recreation and there is not the pressure for use of watershed lands. Still, the State owns land adjacent to the reservoirs and does police the areas; the city has no police powers over the watershed lands.

In California, according to Mr. McFarland, the matter is now under argument. In general, water supply people in California oppose the use of reservoirs for recreational purposes. There are now four bills in the state legislature some of which would allow limited access to reservoirs in mountain areas, but not in local areas.

Saline Water Conversion

David S. Jenkins, Director, Saline Water Research, U. S. Dept. of Interior, Washington, D. C., and Sheppard T. Powell, Cons. Engr., Baltimore, Md. spoke on the subject of SALINE WATER CONVERSION. Mr. Jenkins reviewed the government's program and objectives. In 1952, when Congress authorized the re-

P. D. Haney (Chairman)

J. M. Jester (Vice Chair.)

Purification Div. Officers

C. A. Black (Secretary)

E. J. Allen (Chairman)

J. B. Ramsey (Vice Chair.)

B. E. Payne (Secretary)

Distribution Div. Officers

search there were only three conversion processes known, all costly.

The first step in the program was to develop a list of all possible methods of conversion and screen the list to determine the most likely to succeed. These were then placed under research contracts in various parts of the country.

The following processes are now under study: Distillation, electrodialysis, freezing, nuclear, and miscellaneous. In the distillation processes there are these variations: vapor-compression distillation, solar distillation, forced circulation, dropwise condensation and separation at high temperature and pressure.

In the vapor compression distillation system there seems to be little chance of cost reduction; solar distillation requires low cost construction and needs 5 to 10 sq ft of area for each gallon per day. Electrodialysis costs $0.80 to $1.00 per 1000 gal for waters containing no more than 500 ppm of salts. Concentrations above that are not feasible for treatment by this method.

The cost of power generation from nuclear reactors must become competitive before this approach can be considered. Other processes under consideration are: Osmionic process, semi-permeable membranes, transport depletion. Processes considered, but not under study, include precipitation of salts, ultrasonics, gravitational diffusion, hydration, streaming potential, electromagnetic effects, and electrostatic effects.

For comparative purposes, a standardized procedure has now been developed for estimating costs. Mr. Jenkins concluded that many near future shortages may be relieved by expeditiously and cheaply curtailing water waste rather than by attempting to supplement water supplies by saline water conversion. If replacement by conversion is used as a criterion, waste prevention or supplementary supplies may warrant expenditures of 30 cents or more per 1000 gallons. Within 10 to 15 years we should reach the status where we can afford to pay $40 per acre foot for irrigation water and $100 per acre foot for municipal supplies. Saline water conversion will then be competitive.

Mr. Powell commented on the work of the governmental research projects and their limited successes to date. He also pointed out that the possible use of converted saline waters is not limited to the sea coast, There exist many inland salt waters, particularly in ground waters in several areas. These too, may be considered as potential water supplies when salt water conversion becomes practical.

President
H. E. Schlenz

Pres. Elect.
R. V. Ford

Vice Pres. Elect.
E. E. Alt

Treasurer
R. F. Hayes

Manager
J. G. Stewart

Secretary
D. E. Dimmers

Wat. & Sew. Wks. Mfrs. Assn.

Reservoir Evaporation

L. O. Timblin, Jr., Physicist, Div. of Eng. Labs. Bureau of Reclamation, Denver, Colo., spoke on RESERVOIR EVAPORATION CONTROL, pointing out the importance of reducing evaporation from the standpoint of cost of water supply operations. Co-authors of the paper were W. T. Moran and W. V. Garstka.

Among the possible solutions which appear effective is the use of monomolecular layers of long chain polar materials such as cetyl alcohol. The work of the Bureau included studies of pilot plant experiments, determination of the toxicity of the compounds used, and full scale studies. Currently under study for a full scale evaporation reduction project is Lake Hefner, near Oklahoma City. There field studies are under way, not only to determine the actual reduction in evaporation, but also to develop techniques for application and maintenance of the monomolecular layer of hexadecanol. Methods of film detection and evaluation are also under study.

Weather Modification

A task Group Report on WEATHER MODIFICATION was presented by Burton S. Grant, Asst. Gen. Mgr., and Chief Engr., Dept. of Water and Power, Los Angeles, Calif. The report presented a picture of current professional opinion on the subject of weather modifications.

Mr. Grant reviewed the objectives of his committee as: To keep informed on state legislation that is enacted to control activities aimed at modifying the weather and to act as a central agency for the exchange of information on research and results obtained from continued efforts to modify the weather.

The report reviewed the work and ideas of others particularly Dr. Arnold Court of the University of California and of Ferguson Hall of the U. S. Weather Bureau. Because weather modifications apply only to favorable cloud formations and results chiefly in speeding up precipitation, weather modification would be more correctly considered a "redistribution of precipitation". It seems highly unlikely that any efforts can actually increase the total amount of precipitation on the earth's surfaces. Probably 40 per cent of the total precipitation falls over the oceans and is lost for use.

Honolulu's Supply

In a paper on the HONOLULU WATER SUPPLY, Edward J. Morgan, Manager and Chief Engineer, Board of Water Supply, City and County of Honolulu, Hawaii, described the island, its geology, rainfall, climate, and population. Rainfall may run up to 400 inches a year in some areas. Much of this precipitation permeates into the volcanic rock and is stored in a fresh water lens which literally floats on the underground sea water. It is from this lens that water supplies are taken. Wells and tunnel construction is so arranged as to tap the lens at its center where the fresh water layer is the deepest. In order to increase water storage a system of dikes is used to catch surface runoff.

Two other committee reports were presented before the Resources Division, one on UNDERGROUND WASTE DISPOSAL AND CONTROL by Lynn M. Miller, Geologist, Geol. Sur. Div., Dept. of Consv., Lansing, Mich.; the second report, ARTIFICIAL GROUND WATER RECHARGE by John J. Baffa, Cons. Engr., New York City.

Oregon Water Law

Fred Merryfield, Pres. Elect of AWWA, Prof. of San. Engineering at Oregon State College, Corvallis, Ore., and Cons. Engr. gave a digest of the OREGON WATER LAW. This law created a State Water Resources Board to secure maximum beneficial use and control of the State's water resources. The Board is required to study existing water resources, to formulate programs for the use and control of water, to hold hearings and render decisions on conflicts arising over the use of water. The Board has broad permissive powers to carry out the intent of the Act including authority to do many things.

New Jersey Water Supply

Governor Robert B. Meyner spoke on WATER SUPPLY AND DEVELOPMENT IN NEW JERSEY. The Governor spoke particularly of the initial report of the N. J. Water Resources Advisory Committee for utilizing the waters of the Raritan River basin. Average rainfall in New Jersey is 45 inches a year; there are many streams of varying sizes and there is considerable ground water storage. Thus the problem of water supply in New Jersey is not due to lack of water. Rather it is the matter of storage and distribution, and the increase in industrial water demands.

Although water supply has traditionally been a municipal function, the State of New Jersey is now entering the picture. It has acquired reservoir sites, and it is proposing to develop certain other areas as reservoir sites which will augment the Raritan River. The immediate challenge in New Jersey is to relieve shortages in the Northeastern counties. Two reservoirs are to be purchased by General Obligation Bonds and liquidated by monies received from use of the water. Another reservoir has been authorized for use in connection with the Delaware River.

In South Jersey, there is plenty of water today, but the area is growing and it appeared wise to acquire an area of 91,000 acres to be developed to 200 to 300 mgd supply. This is a long term development for offsetting future problems.

The topic was further discussed by W. H. Baumer, Johnson and Johnson, Inc. of New Brunswick, N. J. Mr. Baumer heads the Citizens Committee on Water Supply and referred to the basis of water needs in New Jersey, namely the growth of both industry and population and the increase in farming and its demands for irrigation water. Mr. Baumer believes that not only must the Raritan River waters be used, but also that additional water supply must be obtained from the Delaware River.

Charles H. Capen, Cons. Engr., Newfoundland, N. J. also spoke on New Jersey Water Supply Development. He reviewed the agencies, authorities and individual companies engaged in the problem. He spoke about the reason for the lack of progress in water supplies in New Jersey, with particular reference for the reasons many laws had failed of passage. He outlined reasons for stagnation of progress and cited the lack of money due to low rates as a contributing factor.

Planning For Water Resources

M. J. Shelton, Dep. Dir., Water Resources, State of California, spoke on PLANNING—KEY TO GREATER UTILIZATION OF WATER RESOURCES. Mr. Shelton reviewed the history of planning in his state and the development of the State Water Plan in 1931. California's pattern of growth has much to do with the overall plan. The first phase of the planning was an investigation and inventory of the States' water resources. The second phase outlined the inventory of the State's requirements for the present and the future.

From these planning efforts came the development of several bold projects. The first unit of the plant, the Feather River Project will cost $1.5 billion and will start this year. It will consist of relocation of highways and railroads in the area to be inundated by the Oroville Dam. It will be five years before flood control is achieved and power development established. Many problems are to be overcome, but Mr. Shelton said the the state could not wait to proceed. He cited ample precedent for going ahead although many facets of the project are still to be worked out.

F. S. Friel

E. S. Chase

D. P. Morse

S. Powell

B. S. Grant

E. J. Morgan

Programmers

General Session

In the absence of Frank C. Amsbary, Vice Pres. and Gen. Mgr., Long Island Water Corp., Lynbrook, L. I., Mr. H. E. Jordan. AWWA Secy., read the report on the AWWA SPECIFICATION AND CERTIFICATION PROGRAM.

Mr. Jordan reviewed the development of specifications, the first being that for cast iron pipe in 1890. In 1908 AWWA and NEWWA joined for specifications on valves, hydrants and pipe. In 1920, the forerunner of the AWWA Water Works Practice Committee was organized. This committee has had only three chairmen in 37 years, Geo. W. Fuller, Malcolm Pirnie, and L. R. Howson. This committee handles all specifications.

Currently the committee is considering the idea of establishing certification procedures and licenses for manufacturers whose equipment meets AWWA specifications. Mr. Jordan reviewed the situation which caused the development of this desire on the part of the Board. The most recent meeting of the Board reaffirmed its desire to set up a system involving the certification mark. There are a number of problems to be overcome but undoubtedly there will be some action forthcoming.

Constitutional Amendments

Harry E. Jordan, Secretary of the Association, spoke on the reasons for the presentation of the constitutional amendments. These changes will eliminate a provision whereby a letter ballot to the Board has been used to vote on various actions of the association as well as to vote on new members. This procedure is not legal.

Under the new constitutional amendments, the procedure for action will be as follows: The Board will be advised by letter of what actions may be proposed for adoption by the Executive Committee. Any member of the Board may interpose an objection, if he so desires and the action must then be delayed until a regular meeting of the Board. Lack of any objection is in effect approval of the action proposed. Hereafter, a Membership Committee, meeting in regular session will act monthly on new applicants for membership.

F. Merryfield

C. H. Capen

H. E. Jordan

Abel Wolman

H. B. Shaw

L. N. Thompson

National Water Policy

Dr. Abel, Wolman, Prof of San. Engng. at Johns Hopkins Univ., and Chairman of the AWWA Committee on NATIONAL WATER POLICY spoke on that subject. Dr. Wolman pointed out that it is now nearly 25 years since the first report was issued. The basis of that report was the assumption that this country needed a more uniform and equitable policy. It stated what the policy should be. Subsequently reports on National Water Policy were issued in 1949 by the First Hoover Commission, in 1950-51 by the President's Committee, in 1952 by the Materials Policy Commission, in 1955 by the Second Hoover Commission, and in 1956 by the Presidential Advisory Committee on Water Resources Policy. There have also been a number of voluntary association reports including the EJC Report of 1951 (revised in 1957), the U. S. Chamber of Commerce Report, The AWWA Policy Committee Report, among several others.

In spite of these many reports, Congressional action has been almost zero. Dr. Wolman asked the question —Why have all of these carefully planned and phrased documents not been translated into action. In answer to this question, he asked several other questions:

Do we need a water policy?—If it has been needed, then it certainly has not been wanted by Congress. Why not? There is a hostility to a policy especially against fiscal policy which makes the beneficiary pay for what he gets. Such a policy would interfere with the freedom of action in sectional and political favors.

Was the policy too early?—It may come later as pressure for water increases. Apparently we must begin to see what will happen if we don't get it.

More Programmers

How much organization is necessary in our lives and how is that to be affected by how much freedom of action we feel is necessary to our happiness. This is a case of organizing our lives as would be done by the professional as opposed to the attitude of the politicians. Dr. Wolman said that the professionals had been wrong before in many instances and perhaps they might be wrong in pressing for a national water policy at this time.

British Water Works Planning

G. N. Binnie, Cons. Engr., Westminster, S. W. England, spoke on WATER WORKS PLANNING IN GREAT BRITIAN. He explained the system of water undertakers, and the problems of low rates which date back to pre-industrial days, when it was decided that all citizens should receive a plentiful amount of water and should pay for it, not according to what they used, but according to what they could afford. There are few private water companies and most of the municipal utilities are small. Many authorities overlap and there is much inefficiency. At present there is a strong movement toward the regrouping of the smaller authorities into larger ones. Until recently the British Water Works Assn. has kept hand off of this movement, but now it has come forward in favor of the plan. Otherwise it sees that more central government control under nationalization plan may well result.

Highway Relocation

A panel, moderated by Harry B. Shaw, Chief Engineer, Washington Suburban Sanitary Commission, discussed the HIGHWAY RELOCATION PROBLEM. Mr. Shaw emphasized the need for continued work to bring equity to this situation. Only four states now have laws which provide for repayment of costs where utility relocation is made necessary by virtue of new highway reconstruction. An act of Congress provides for repayment by the state when federal funds are used on the highway, but there is now a bill before congress to abolish that provision. Mr. Shaw proposed the committees be formed in AWWA Sections to press for local and state legislation to abolish this burden on water utilities and place it on highway costs where it belongs.

Each of eight participants on the panel cited conditions in their respective areas and told of specific problems. In very few instances has the situation been worked out satisfactorily to water utilities.

Water Works Administration

Joint Administration

L. N. Thompson, Gen. Mgr. Water Dept., St. Paul, Minn., is presenting the report on JOINT ADMINISTRATION OF WATER AND SEWAGE FACILITIES, stated that a questionnaire had been sent out to 1000 cities of 10,000 population or more, and to date, 437 cities had replied. The answers received showed that the replies did not necessarily represent the opinions of the individuals, but rather a reflection of the local laws and administrations that they were working under.

It was also found that there was no connection between joint administration and joint operations; however, there are basic advantages in-

herent in joint administration, definitely in the smaller cities, and to a lesser degree in the larger cities. So far, the survey shows a trend toward a general increase in sewer service charges.

Water Main Extensions

The WATER MAIN EXTENSION POLICY was reported by L. S. Finch, V. P. & Chief Engr., Indianapolis Water Co., Indianapolis, Ind. This report showed that no common yardstick has yet been developed in regard to the difference between charges for supplying water to existing customers and future customers. The committee also reaffirmed the basic tentative policies as set in 1949.

In furthering the statement that new extensions should be self-supporting, Mr. McDaniels of Los Angeles stated that the company should obtain sufficient guaranteed annual revenue from new main extensions to assure its installation and operation.

Revenue Producing Water

In reporting on REVENUE-PRODUCING WATER, E. Shaw Cole, V. P. & Chief Engr., Pitometer Assoc., stated that an audit should be made of the amount of water delivered into the system and the metered water sold. All public water use—schools, hospitals, parks, street flushing, estimated fire flow, etc.—should be metered even if no charge is made for such water use.

The ideal ratio between water used and water delivered to the system is between 85 and 90 percent on metered systems. Per capita use is not necessarily a correct yardstick, and also all industrial use of water should be eliminated from the audit to obtain a correct metered ratio. A low ratio does not necessarily indicate that the situation is ideal, until it is proved that as much "unaccounted-for-water" has been eliminated from the system as is economically feasible.

Rating Scale

In the report on a RATING SCALE FOR WATER WORKS, John H. Murdoch Jr., Consultant, American Water Works Service Co., emphasized the need for a numerical scale for rating the efficiency of a water supply company. He stated that Mr. O. E. Brownell, Minneapolis, Minn. contributed a system of rating whereby an individual part of the plant can be rated against a standard of excellence, and the degree of variance from the standard can be calculated by using figures from the individual plant statistics in the master formula. Also a management rate should be established to pro-rate man-hours.

Safety Practices

R.J. Faust, Exec, Secy., A.W.W.A., in reporting on the safety program stated that safety manuals are now available and that the award program is being started.

The award program will operate strictly from the section level, not from the AWWA headquarters. The three awards now given at the section levels are 1) Progress Award, 2) Award of Merit and 3) Award of Honor. To be eligible for the Award of Honor, the frequency of accidents in the plant must be reduced by 60%. The group is also contemplating a top award, to be given by the AWWA and will be called the Wendell La-Due Award. The group is also considering the production of a film on Water Works Safety.

In-Service Training

Mr. Faust also reported that a survey of various short courses showed the need for elevating the general overall improvements in most of them. There are some short courses that are doing an excellent job.

He also suggested that a series of six training manuals should be printed for use by short schools. The series would consist of from 120 to 160 pages each, and the general titles suggested are: 1) Neophytes, 2) For Beginners, 3) Ground Water and Treatment, 4) Surface Water & Treatment, 5) Treatment of Water and 6) Management. Over 70 members of the AWWA are contributing to the writing of these manuals.

Publicity Program

E. L. Filby, Black & Veatch, Kansas City, Mo., in the report on publicity stated that water works management and the superintendent, etc. should supply the local press with all types of information concerning the water works. When new mains are being laid, new valves, etc. and establish a very friendly and firm footing with the editors and reporters of the local press. By the establishment of such a relationship, the water works will be in a much better position to present its story to its customers when rates are to be raised, etc. and some of the generally unfavorable publicity will be avoided or played down.

L. S. Finch

E. S. Cole

J. H. Murdoch

R. J. Faust

E. L. Filby

E. L. Bean

And More Programmers

Air Conditioning

E. L. Bean, Chief, Treatment Section, Philadelphia Water Dept., reported that a questionnaire had been mailed out requesting information regarding rules, regulations and charges for water use for air conditioning. To date, only preliminary figures were available as only 560 replies had been received. These preliminary data show that 81 of the communities having rules and regulations regarding the use of water for air conditioning, 19 indicated that they have specific charges for such usage. It was also shown that some communities have a per ton charge plus the cost of the water used.

Mr. Bean also stated that the outside temperature is no longer a deciding factor in the use of air conditioning. The internal heat load of a building is a determining factor today. By 1970, it is predicted that 90 percent of the southern factories will be completely air conditioned. Also the Arkansas high court ruled that air conditioning was as much of a necessity in public buildings as telephones, etc. The sale of air conditioning equipment in 1956 increased 1/3 over 1955.

RAW WATER STORAGE for seven days, and waste water reclamation, are featured in new supply and treatment plant serving desert city.

New El Centro Water Plant

Designed and constructed to supply desert city's 600 gpcd domestic demand at low cost

by JOSEPH F. GOLDEN
Partner, Golden, Bryant, & Jehle
Architects and Engineers
El Centro, Calif.

THE IMPERIAL VALLEY of California is an agricultural wonderland, known the world over for its fabulous crops and its 115 degree summer temperatures. El Centro, a county seat with a population of almost 18,000, is located in the heart of this valley, about 10 miles from the Mexican border.

El Centrans live and work in air conditioned buildings, drive air conditioned cars, and consume almost 600 gpd of water per capita during the hot summer months, without any assist from industry. This is probably the world's record for purely domestic water consumption.

The source of all water for irrigation and for domestic use for this entire valley is the Colorado River. Water is diverted from the river at Imperial Dam, about 20 miles upstream from Yuma, Arizona, and flows to the valley through 100 miles of the All-American Canal, one of the largest ditches in the world.

From the terminus of this canal at the southern edge of Imperial Valley, which is also the Mexican boundary, the water is carried northerly through smaller canals spaced approximately ½ mile apart to irrigate the farmland and supply the five cities of the valley. These canals are the lifeblood of this land, without which it would again revert to desert. Obviously, water supply is a very important matter to the people of El Centro.

El Centro's first filter plant was a slow sand filter of the Blaisdall type, constructed in 1924. This plant supplied the city until 1946, when additional filters of the rapid sand type were constructed to bring the plant capacity up to a rated 6½ mgd. By 1951, the plant was having difficulty in meeting the demand, even while operating at 25 percent over its rated capacity. Other water problems also began to beset the city.

The long, tenuous connection to the source of the water supply, together with the ever-present danger of a canal break, which could cut the city's lifeline, presented some problems. The Imperial Irrigation District, a publicly-owned agency that operates the canal system throughout Imperial Valley and delivers water to the cities, requires that each city provide itself

MODERN architecture, a feature of plant building, which has chemical warehouse at deck height on right and booster pump room on left. Two-story section houses clear well transfer pumps.

with a minimum of seven days normal supply of raw water storage. For this reason, El Centro had gradually accumulated approximately 40 mg of storage in earthen basins covering about 50 acres within the city.

After World War II, new subdivisions began to engulf the old plant and basins, and the seepage from the unlined basins caused the surrounding water table to rise. Alkali patches appeared in adjacent gardens, the trees died, and pavements failed. Adjoining landowners instituted damage suits against the city.

Another critical point in the city's supply system was the old pumping station, with the pumps located in a pit about 15 feet below the normal ground surface, where a break in the plant piping would flood the pump pit and drown all of the pump motors and electrical gear.

Engineers' Recommendations

Faced with this dilemma, the city, in 1952, and again in 1953, secured engineering reports from two independent firms. These two reports were in general agreement. Their recommendations to the city were as follows:

1. The existing plant was incapable of economical enlargement.

2. The existing plant site was too small. The required seven-day supply of raw water, amounting to 70 mg, was considered definitely undesirable for location in the heart of a residential area.

3. It appeared infeasible to construct a new plant on the existing site, meanwhile maintaining the old plant in operation during the construction period.

Both engineering firms recommended that a new plant be constructed on a new site, south of the existing city limits, in the direction of expected city growth, with initial capacity to supply 25,000 population, readily expandable, and providing the necessary seven days supply of raw water. Each firm estimated the cost of this project at more than $2,000,000.

Financing

Upon receipt of this shocking advice, the City Council appointed a Citizens Committee to assist the City Manager in studying the problem. The committee, after much deliberation, accepted the advice of the engineers; however, they voted to limit the bonds to $1,300,000. On April 13, 1954 the city voted overwhelmingly for the issuance of $1,300,000 of general obligation bonds to finance the new plant.

The City Council diverted $150,000 in available capital outlay funds to the project, making a grand total of $1,450,000 available for the project, including land and engineering fees.

The consulting engineers who were then employed to prepare the plans, and specifications were faced with the problem of producing, for $1,500,000, a plant which had been estimated to cost $2,000,000. The plant, which was completed in October 1956, contains all of the features covered by the original engineering reports, and was built within the budget.

Design Problems

Some rather unusual problems were encountered during the detailed design of the project. Previous economic studies had determined that municipal water softening would not be economical because of the extremely heavy use per capita, most of which went for lawn sprinkling, air conditioning, and other non-domestic uses.

The turbidity of the water supply was about 10 ppm, occasionally running as high as 50 ppm. The average water analysis showed a pH = 8.5; M alkalinity = 120 ppm; P alkalinity = 6 ppm, with a total hardness of about 320 ppm.

Seasonally, the water carried a zoogleal slime that could not be removed by ordinary detention and settling. This slime, if not removed, penetrated the filter sand causing short filter runs and eventually ruining the sand bed. The nearby city of Calexico, using the same source of water, had excellent results over a period of years in the use of an Accelator, a solids contact-type clarifier. On the basis of this experience, this type of unit was selected for the new plant. Filtration and disinfection were the only other required treatments.

The most challenging problems concerned the tremendous amount of raw water storage required, and the lack of any available drainage channels in which to waste any water from the site. The only water leaving the site would be the treated domestic supply to the city.

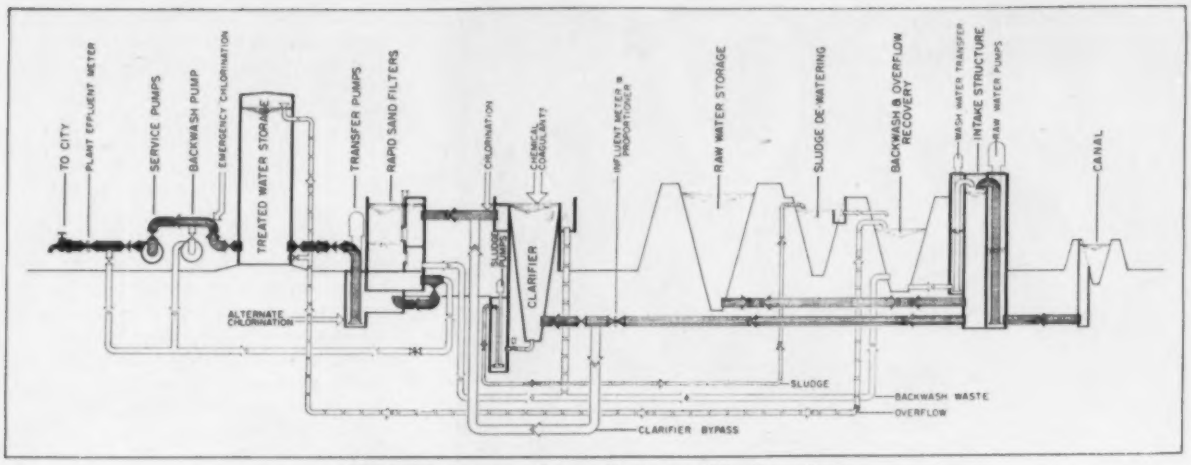
Double Supply Source

The site acquired for the new plant consisted of approximately 80 acres of level farmland, bounded on the east by the Date Canal, and on the west by the Dahlia Canal. These canals are the sole source of supply for the city, and both terminate at the south city limits. The maintenance of these canals required that they be taken out of service for three days each month, to kill the heavy growth of moss, and also for general maintenance.

Because both of the canals would not be out of service simultaneously, a delivery gate was provided from both these canals, thus assuring the city of a continuous source of supply so that the basins could be maintained practically full at all times.

Site Conditions

Borings at the site indicated a heavy clay, locally known as adobe,



PROCESS diagram of new El Centro filtration plant.

with occasional thin silty layers to a depth of 5 or 6 feet. At 5 feet, the soil was very moist and spongy, and ground water occurred at about 7 feet. Laboratory tests indicated that this material was suitable for basin embankment after compaction to 93 percent density. From these findings, it was evident that it would be impractical to excavate more than about 4 or 5 feet for the storage basins. Even at 5 feet, the wet spongy bottom would hardly support earthmoving equipment.

The maximum elevation of the water delivery from either of the canals was about 1 foot above natural ground at the site, which would allow a total depth of only about 6 feet, assuming gravity flow from the canal. The necessary 70 mg, amounting to 214 acre-feet, would, on this basis, occupy 40 acres, and would require 350,000 cubic yards of excavation. The excess excavation over the embankment would fill the remaining 40 acres of the site to a depth of more than 7 feet.

It was considered extremely important to provide a lining for the basins as protection against wave erosion, weed growth, and to permit periodic wash-down. It was expected that there would be a small amount of solids deposited in the basins as a result of the relatively long detention periods during the winter when the city's water consumption was low. Gravity basins would require 220,000 square yards of lining for the bottoms and slopes.

Alternate Basin Design

The heavy excavation and the large areas of lining required caused the engineers to seek other solutions. It became evident that considerable savings in amount of earthwork and in the basin linings could be effected if the storage depth could be increased. For that reason, the water depth of the basins as finally designed was fixed at 16 feet, approximately 5 feet in the ground and 11 feet above ground.

Pumps were provided to lift the raw water into the basins, from which it would flow through the plant by gravity. The same raw water pumps were arranged to be used for lifting the water to the plant whenever it became necessary for the city to draw on the raw water storage.

This scheme decreased the required excavation from 350,000 to about 110,000 cubic yards, and the higher basin embankments utilized all of the excavated material. The smaller, deeper basins also decreased the amount of lining required from 220,000 to about 89,000 square yards, and cut the total area of the basins from 40 to 18.2 acres.

The approximate net saving in excavation and basin lining, after allowance for the $20,000 increased cost of embankment, amounted to $184,000, based on the final actual contract unit prices. The total plant, including the storage basins, equipment, storage yards, with space for future expansion, occupied a total of 50 acres of the site. The remaining 30 acres the city has leased out for agriculture use.

Raw Water Storage and Handling

Raw water is stored in two identical basins, each 512 by 652 feet, top inside dimensions, with a 16-foot water depth and 2-foot freeboard. Embankments are of native material compacted to 93 percent, with 14 foot top width, 2:1 inside slopes and 1½:1 outside slopes, and are lined with 3 inches of asphaltic concrete.

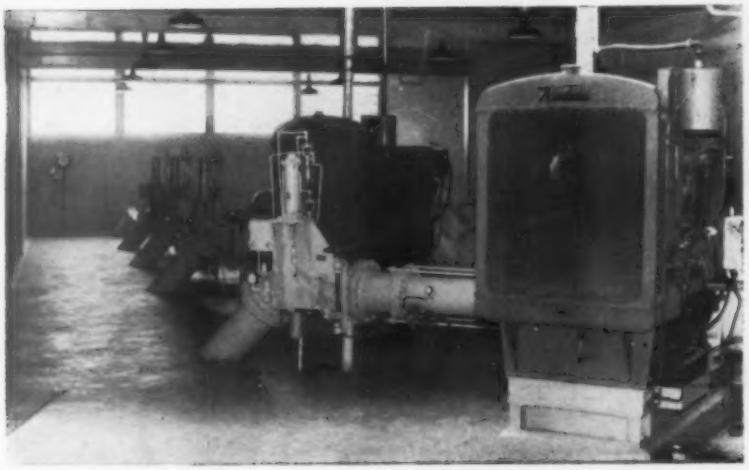
Each basin is provided with an access ramp leading to the bottom, which is sloped to a small drain sump in the low corner.

Whenever the basins require cleaning, water will be pumped from the adjoining basin by means of a high pressure, portable, gasoline-driven pump. The empty basin will be hosed down, and the settled material sluiced toward the sump, where it will be picked up by the suction hose from a second gasoline-driven portable pump connected to a discharge header, which carries the washed-down materials to the sludge decanting basin.

Raw water is delivered from either of the two canals through underground pipelines to a multi-chambered concrete structure. This structure contains six separate cells, and 11 sluice gates varying in size from 24 inches to 42 inches square. The raw water intake sump contains four vertical propeller pumps ranging in size from 12 inches to 18 inches and having a capacity of from 2,000 to 5,900 gpm each.

One of the pumps is driven through a variable-speed magnetic drive, and the pumps are controlled in a stepless program of from 2,700 to 16,700 gpm to maintain the elevation in the raw water intake sump within about 6 inches. The purpose of this arrangement is to maintain the sump always a sufficient distance below the canal delivery elevation, so that the Irrigation District can measure the water delivered to the city through standard delivery gates. The stepless program eliminated the need for a large pump sump.

The 11 sluice gates permit the water to be diverted through this structure in almost every conceivable way. Normally, the water is pumped up into one basin, from which it circulates through an interconnecting pipe into the second basin, and then flows



HIGH SERVICE pumps with automatic combination check and isolating butterfly valves. Two pumps at right are dual-drive with emergency stand-by gasoline engines.

by gravity to the plant. However, it is possible to pump directly to the plant, bypassing the basins completely, or to pump one basin down into the other basin, or to pump partly to the basins and partly to the plant, as desired. In addition, whenever the canal water is not available, the basin water can be run through the plant by gravity until the elevation drops to a point where it is necessary to pump, and then it can be pumped into the plant.

Clarifier

From the raw water basins, the water normally flows by gravity into the clarifier. A bypass is provided so that the clarifier can be taken out of service, if necessary. Water level in the clarifier is controlled by a pneumatically-operated, 36 inch butterfly valve, through a pilot float controller. This device maintains the clarifier water level at a constant elevation, regardless of the height of the water in the basins. The clarifier, an 86-foot diameter concrete tank operating on the solids contact principle, utilizes a patented mechanism, the Accelator. The unit has a nominal capacity of 16½ mgd at a 2½-gpm-per-square-foot overflow rate.

Water flowing into the clarifier is measured at the inlet by a Sparling propeller meter, which indicates the total plant input on a recording meter in the control room. This meter also automatically proportions the chemical feed to the clarifier, and the prechlorination ahead of the filters.

The precipitated solids and the coagulants introduced into the clarifier are removed through automatically controlled diaphragm blow-off valves, which discharge the sludge into a sump adjacent to the clarifier. Two 300-gpm pumps are provided to transfer the sludge to twin basins located adjacent to the main storage basins. In these basins, the sludge is dewatered by a skimming structure located between the twin basins, and the skimmed-off water flows into the adjoining wash-water sump, where it is pumped back up into the raw water basins. Periodically, alternate sludge basins will be pumped down and allowed to dry out, and the remaining dry material can be excavated with a skip loader and hauled off by truck.

Sand Filters

The clarified water flows into the filters through a concrete flume across the end of the filter structure. Three double-bay, rectangular, rapid sand filters are provided, each filter bay being 13 by 36 feet, with an area of 473 sq. ft. each. The underdrain system consists of 4 inch Transite pipe laterals 11⅝ inch centers, located transversely across the narrow dimension at each filter, and feeding into a central concrete gullet. The pipe laterals are perforated with ½ inch diameter holes at approximately 3¾ inch centers on the bottom, and are supported on small concrete saddles a few inches above the filter floor.

The underdrain pipes are spaced apart with precast concrete Wagner blocks and 14 inches of graded gravel (from 1½ inch to ⅛ inch) in uniform layers over the pipe underdrains. Over this gravel was placed a bed of silica sand, consisting of 4 inches of coarse sand with an effective size of 1mm. minimum, and a uniformity coefficient of 2.0, maximum, and 20½ inches of fine sand with an effective size from 0.55 to 0.60 mm., with a uniformity coefficient of 1.7, maximum.

Each filter bay contains six wash water troughs and three rotating surface wash arms. Wash water troughs are of prestressed fiberglass, 17 inches top width, 18 inches in total depth, with a cylindrical bottom. As far as is known, this is the first use of fiberglass for wash water troughs, the intent being to obtain a reasonably priced trough which would be noncorrodable, thereby eliminating the heavy maintenance expense of constant painting. Filter influent and waste channels are concrete box sections, with 24 inch hydraulic influent sluice gate and 30 inch square hydraulically-operated waste gate.

The bay separation valves and the backwash valves for each pair of filters are 16-inch hydraulically-operated butterfly valves. The filter rate controllers are pneumatically-operated butterfly valves, controlled by air pressure transmitted by a differential converter. The rate of flow controllers are also utilized as filter effluent valves by means of an intercepting three-way air valve in the control tables.

Control tables are of welded anodized aluminum. Backwash water is supplied by an 8,000-gpm centrifugal pump. Wash water rates are measured by an orifice plate, and indicated on a large dial visible from the operating tables. The filter controllers are designed for a maximum capacity of 6 mgd each, and all filter piping hydraulics are based on this flow. Backwash water is discharged from the filters to the wash water basin, from which it is pumped back into the raw water basins for re-use.

Clearwell and Storage

The area under the filters is utilized for a small clearwell, with a transfer pump sump at one end. The floor of the clearwell is contructed of ½ inch prefabricated asphalt panels. The transfer pump sump at the end of the clearwell contains three vertical propeller pumps having a total capacity of 18 mgd. These pumps transfer the water from the clearwell to the treated water storage reservoirs through a 30 inch concrete pipeline.

Treated water is stored in two 24 foot high by 133½-foot diameter steel tanks, with a capacity of 2.5 mg each. The inlet and outlet to the tanks are 90° apart to provide positive circulation through the tanks and to avoid dead spots. From the treated water storage tanks, water is delivered to the city by the service pumps, which are automatically programmed to meet the demand.

Service Pumps

Four horizontal double-suction centrifugal pumps are installed for high-service duty, having a total capacity of approximately 18 mgd. Space is provided for a future fifth pump. Two of the pumps, rated at 6 mgd each, are dual-drive, and powered with gasoline engines for standby use. Water is pumped to a 250,000-gallon elevated tank in the city through approximately 1½ miles of 30 inch and 24 inch pipeline.

All of the service pumps connect to a common suction header and discharge into the transmission pipeline. A propeller-type meter is provided in the discharge header to measure the total plant output, and to control post-chlorination, if so desired. Each service pump is equipped with an automatic check valve, consisting of a 12 inch pneumatically-operated butterfly valve controlled through a pressure-operated pilot. These valves are adjusted to open slowly when a pump starts, and to close in advance of a pump shut-down, utilizing time-delay relays for this purpose.

In addition to the two gasoline engine-driven (dual-driven) pumps, a 150-kw gasoline engine-driven standby generator is provided to power the raw water pumps and other necessary plant utilities during power outage.

Coagulants

Laboratory tests prior to design indicated that the most useful coagulant would be ferric sulfate, with powdered limestone as a coagulant aid. One powdered limestone feeder and two ferric sulfate feeders are provided. The limestone feeder can also handle lime, and the sulfate feeders can handle alum, if desired. Chemicals are received in sacks, and stored in a chemical storage warehouse located at truck bed height.

Charging hoppers are recessed in a pit in the warehouse floor, and individual vertical screw conveyors carry the dumped chemicals up into storage bins located over each feeder. Each bin will store more than a day's supply of chemicals. The bins are each equipped with high and low limit switches, which cut off the conveyors when full, and cause an alarm in the control panel when the bin is nearly empty.

The base chemical feed rate is manually set at each feeder, after which the feed is automatically proportioned to the flow into the clarifier, as measured by the plant influent meter. Chemicals are transported in solution to the primary mixing chamber of the clarifier. Lime is carried in a stainless steel trough; the ferric sulfate is transported in Uscolite pipe. Pipe and troughs are supported on a walkway from the clarifier to the chemical feeder room, which enables the operator to keep the trough clean, and eliminates the plugging up which has been a source of considerable trouble at a number of other plants.

FILTER bay with Palmer surface wash and fiberglass wash water troughs.

Chlorination

Chlorinators are located in a separate space adjacent to the chemical warehouse, and are also at truck bed height. Chlorine is delivered in ton cylinders, rolled off the delivery trucks onto the dock floor. At this point, the cylinders are picked up on a chain hoist and carried on an overhead track into the chlorine room.

A 4,000-lb. capacity, dial-type platform scale holds two cylinders, with space alongside for a spare cylinder. The scale dial is equipped with an adjustable magnetic switch, which is set to sound an alarm on the control panel when it is necessary to switch cylinders.

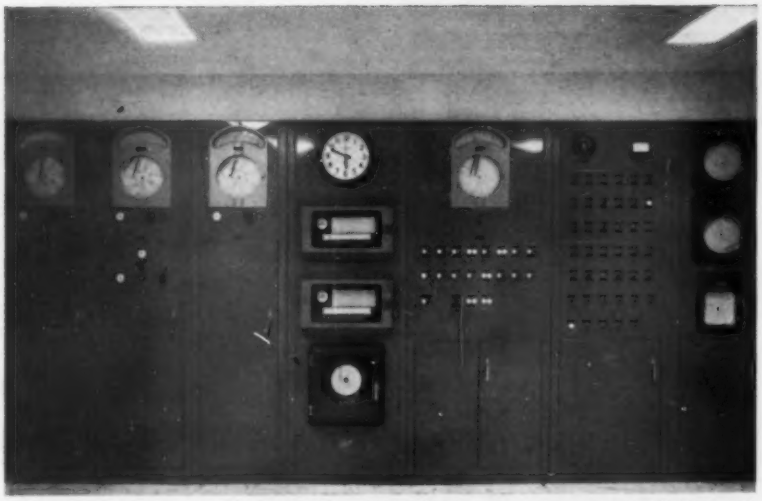
The chlorine room is cooled by evaporative cooler, and is provided with thermostatically controlled electric heat. A two-speed exhaust fan picks up air near the floor and discharges through the roof. This fan is controllable from outside the chlorine room.

Chlorination equipment consists of two identical automatic proportioning solution feed, visible vacuum-type chlorinators, each having a capacity of 400 pounds per day. A multi-pole rotary switch permits each chlorinator to be controlled by either the plant influent or effluent propeller meter. In addition, a two-in, three-out, valve manifold permits selection of either or

both chlorinators for any of three alternate points of chlorine application.

Normally, chlorine is applied to break-point, just ahead of the filters. Other chlorine application points are located in the clearwell transfer sump, and in the transmission pipeline to the city. The base chlorination rate is manually set at each chlorinator, after which the chlorine is automatically proportioned in accordance with the fluctuating flow, as determined by either plant influent or effluent meter, as selected by the plant operator.

A chlorine residual recorder measures the residual from a continuous sampling of plant effluent. The sampling cell is located in the laboratory, and the recorder is located in the main control panel in the control room. Any variation in chlorine residual beyond the adjustable set limits will cause an alarm on the control panel.



MAIN control panel with recording and indicating meters, tell tale lights and and process alarms.

Laboratory and Sampling

A small laboratory is located on the ground floor level, directly under the control room. The laboratory is provided with a stainless steel work sink and micarta counter, into which is built a sampling sink. A cabinet with sliding glass doors contains the necessary equipment and reagents for simple routine tests. No facilities or equipment are provided for bacteriological tests; this work is done by a local commercial laboratory. The necessary equipment is provided for tests of turbidity, hardness, pH, calcium carbonate stability, chlorine residual, and other standard tests.

Samples from six key points throughout the plant are piped directly to the sampling sink, which permits the operators to secure all necessary samples directly in the laboratory. Samples are taken of the raw water, clarifier primary mixing chamber, filter influent, filter effluent, treated water storage tank effluent, and plant output. The plant effluent sampling line is connected to the sampling cell of the chlorine residual recorder, which is also located in the laboratory.

Control Room and Panel

The control room is located on the second floor, at the level of the filter and clarifier walkways. The room has two glass walls overlooking the pump room, the filters, the pipe gallery, and the clarifier. One entire wall is occupied by the main control panel, on which is indicated and recorded all of the plant functions. The control panel includes all of the various gages, converters, regulators, and other control equipment normally scattered throughout a plant. The filter gages, which are usually mounted on the operating tables, are omitted in this plant. Instead, a recording loss of head and rate of flow gage for each filter is located in the main control panel. The panel contains the following indicating and recording instruments:

1. Plant influent and effluent (Sparling Striptographs).
2. Raw water basin storage level.
3. Treated water storage tank level.
4. Clearwell level.
5. Chlorine residual (sampling cell located in laboratory).
6. Plant water pressure.
7. Remote distribution system pressure (telemetered from elevated tank).
8. Filter rate of flow and loss of head.
9. Master filter rate controller.
10. Standby engine exerciser and test recorder.

Also included in the panel are the running and demand signal lights for raw water pumps, clarifier, sludge pumps, clearwell transfer pumps, and service pumps. It is thereby possible to see at a glance which pumps are running, and whether they are under manual or automatic control.

Alarms

A comprehensive system of alarm signals, each with a silencer, is included in the alarm section of the panel. Any abnormal condition is indicated on the panel, sounding an alarm, which notifies the operator exactly which point is malfunctioning. Alarm signals are provided for the following:

Manufacturers and Suppliers of Principal Items of Equipment

Service pumps—Fairbanks Morse, and De Laval Pump Co.
Clearwell transfer pumps—Fairbanks Morse Co.
Sludge pumps—Nagle Pump Co.
Raw water pumps—Cascade Pump Co.
Variable-speed drive—Louis Allis
Air compressor—DeVilbiss
150-kw generator—Frazier-Wright Co.
Chlorination equipment and Chlorine residual recorder—Wallace & Tiernan
Clarifier (Accelator—Infilco, Inc.
Chemical feeders, hoppers and conveyors—Infilco, Inc.
Surface Wash System—Palmer Eng. Co.
Filter rate controllers and filter gages—Inflico, Inc.
Clarifier basin controller—S. Morgan Smith
Transmission line valves—Rockwell-Nordstrom
Filter troughs—Reinhold Engineering & Plastics Co.
Automatic check valves—S. Morgan Smith
Propeller meters—Sparling Meter Co.
Telemetering and control equipment, and main control panel—Automatic Control Co.
Power panels—Square D Co.
Transmission pipeline—American Pipe and Construction Co.

OUTDOOR filter pipe gallery and walkway with open-air filter control table.

1. Plant water pressure (high or low).
2. Distribution system water pressure (high or low).
3. Control air pressure (low).
4. Chlorine cylinder (low) (switch in chlorine scale dial).
5. Gasoline storage (low) (Magnetrol in underground tank).
6. Clarifier sludge sump (high level).
7. Elevated tank (overflow).
8. Chlorine residual (abnormal) (limit switches in residual recorder).
9. Chemical storage hoppers (low) (Bin-dicator switches).
10. Filters (high head loss).
11. Clarifier or filter (overflow).
12. Clearwell (overflow).
13. Filtered water storage tanks (overflow).
14. Filtered water storage tanks (low water).
15. Raw water basins (high water).
16. Raw water basins (low water).
17. Gasoline engine test run failure.
18. Power failure.
19. Plant pilot failure.

Automatic Features

Filter backwashing is done manually whenever the control panel signals the preset head loss. Except for backwashing and maintaining chemicals in the storage hoppers, the plant will operate unattended, and is fully automatic in every respect. The control system is partly pneumatic and partly electric, and is designed to be fail-safe. Whenever the plant pilot circuit is interrupted as a result of high or low water, or any other alarm condition, the plant will shut down until the situation is remedied.

The water levels in each tank, sump or basin are measured by bubblers, which actuate pneumatic indicating instruments and also control the various pumping programs. Filter rate of flow controllers also operate on the controlled air pressure principle. A float-operated transmitter located on the elevated water tank at the opposite end of the city from the plant telemeters the water level to the plant via leased telephone lines. This signal actuates a program controller, which operates the four booster pumps on a seven-step, pump-up program to supply the city demand. On city demand, the resulting water level drop in the filtered water tanks allows the clearwell transfer pumps to operate on a pump-down program of the clearwell.

Water level drop in the clearwell restores the plant pilot high water cut-off, which allows the filter controllers and the clarifier influent valve to open. The fliter rate of flow controllers will modulate their rate in accordance with level of the filtered water storage tanks. Under this arrangement, the filters will operate at the minimum rate of flow necessary to keep the filtered water storage tanks full at all times. When the city demand is satisfied, the following cycle takes place:

Construction Contractors

Water treatment plant—Fred J. Early, Jr., Co., Inc.

Raw water storage basins—N. L. Basich Co.

Water transmission pipelines—Glanville Plumbing Co.

Filtered water storage tanks—Chicago Bridge & Iron Co.

1. The water level rises in the remote elevated tank, shutting down the service pumps in sequence.

2. The water level rises in the filtered water tanks, causing the filter rate of flow controllers to gradually reduce their flow down to about 20 percent of capacity.

3. When the filtered water tanks are completely full, the high water cut-off will shut down the clearwell transfer pumps.

4. The clearwell level continues to rise from the 20 percent flow from the filters until the clearwell is full, at which point the high water cut-off will open and de-engerize the plant pilot circuit, thereby causing tight shut-off of all the filter rate of flow controllers and the main influent valve. At this state, the filtered water tanks, the clearwell, the filters and the clarifier are all full, and flow through the plant has ceased. Also, the de-energizing of the plant pilot has cut off the chemical feeders and the influent chlorination. Failure of the raw water supply will cause the clarifier level to drop, and the resulting low water in the filters will operate the low water cut-off and will shut the rate of flow controllers down tight. A low-limit switch operated from the influent propeller meter will open on low flow, thereby shutting off the chemical feeders and the chlorinator.

Plant Design

The filter tanks and clarifiers are of concrete, and the filtered water tanks are of welded steel. The clarifier and filters were supported on piling because of the poor foundation afforded by the soils at the site. The steel treated water reservoirs were constructed without special foundations; however, allowance was made for the predicted 5 inch settlement by providing O-ring slip joints at the pipe connections to the inlet and outlet of each tank.

The central circular slab in the bottom of the clarifier tank was also supported directly on the earth, although the clarifier walls were founded on piling. This circular slab was provided with an O-ring water seal around the perimeter, designed to permit 5 inch settlement without leakage. The clearwell under the filters has a floor made of prefabricated asphalt panels ½ inch thick. A tile underdrain system in a gravel bed is provided under the clearwell and under the clarifier, and discharges into the clarifier sludge sump.

The plant building was designed of rigid steel frame, with a steel roof deck and pumice block filler walls. The tower section, which houses the chemical storage hoppers, utilizes the same steel roof decks as wall panels.

The entire plant building is ventilated, using two evaporative blower-type coolers with a total capacity of 26,000 cfm, designed to remove equipment heat. In addition, the laboratory and control room are completely air conditioned.

Fiberglass Filter Troughs

The filters were designed using the high-rate experiments of Baylis and others as the basis, and will permit rates as high as 4½ gpm per square foot. The filter troughs are built entirely of fiberglass. They are 17 inches wide, 18 inches deep, 13½ feet long, with ⅛ inch wall thickness, and utilize 1½ x 1½ x ⅛ inch fiberglass angles as stiffeners.

The troughs were vacuum bag molded, using a undirectional glass material impregnated with polyester resin. This material has a tensile strength of 73,000 psi and a flexural modulus of elasticity of 4,000,000 psi.

The tested deflection of the troughs when fully loaded is approximately 3/16 inch. It is believed that this is the first use of fiberglass for filter troughs.

The filter control tables were shop-fabricated of anodized welded aluminum, and are completely weather resistant.

General Project Description

The over-all project includes the raw water storage basins, the treated water tanks, and the treatment plant and building, as well as the transmission mains into the city. Steel cylinder pipe was used for the pipelines, and the valves are of the lubricated plug type. Two lines were provided from the plant into the city by different routes; one secondary line consisting of 6,000 feet of 18 inch diameter pipe, and the main line, consisting of about 7,000 feet of 24 and 30 inch pipe. The plant was built under four separate construction contracts, as follows:

Water treatment plant, including raw water structures and yard piping	$647,000
Raw water basins	$174,000
Treated water tanks, including paint and cathodic protection	$164,000
Water transmission pipelines	$171,000

The city purchased the treatment and control equipment, pumps and compressors, generator, and wash water troughs directly from manufacturers and suppliers, and furnished them to the General Contractor for inclusion in the project.

The cost of the filter plant and building, excluding the high service pumps and the treated storage, amounted to approximately $654,000, or about $40,000 per million gallons of capacity for this 16.5-mgd plant. The total project cost, including land and fees, was 1,450,000.

The foundation investigations for the project were made by the Converse Engineering Co., Pasadena, and the designing and supervision engineers for the project were Golden, Bryant & Jehle, Architect & Engineers, of El Centro. Leonard McClintock, City Manager, administered the project for the City of El Centro.

Federal Grants Made to 225 Municipalities for Sewage Treatment Works

A report by the U. S. Public Health Service reveals that in February and March 1957 additional Federal water pollution control grants totaling $15,212,939 were made to 165 municipalities to help build sewage treatment works.

These cities and towns, ranging in population from 269 to 353,000, will add $49,928,035 of their own funds to the Federal grants.

Since the beginning of the program last December, a total of $19,096,474 in Federal grants has been made to 225 municipalities for sewage treatment plant construction. The communities are adding $61,798,723 of their own money.

The average Federal grant has been about $74,000. Congress last year authorized annual grants of $50,000,000, up to an aggregate of $500,000,000 over a 10 year period for the construction of sewage treatment works. It limited individual grants to $250,000 or 30 percent of the total project cost, whichever is less.

It is to be noted that up to April 1 less than half of the $50,000,000 available the first year for grants had been awarded applicants. Also it is to be noted that the House of Representatives has voted to continue the $50,000,000 annual appropriation for aid in sewage treatment plant financing.

Says "The Santa Cruz Sentinel"

"No one minds working in the sewers of Los Angeles—it's such a relief from L. A. smog."

Now! What About Air Conditioning?

An open letter from one superintendent to another

Dear Bill

Your correspondence has been read with great interest. There is one subject, however, that you have not covered. It is a matter I think is of great importance. One that many persons have not given any consideration to and one that no one seems to know what to do about, even if they have given consideration to it.—I refer to the subject of air conditioning.

It will not be many years until homes will be considered obselete if they are not equipped with air conditioning. And you may rest assured that window units will be condemned to the same fate as the pot belly stove. The general phychology of the average American will be such that he will no more permit a hot, humid house in the summer than a cold damp one in the winter. It is coming. All water utility operators had better recognize the inevitable and build up a defense rather than try to make excuses when such demands overreach the capacity of their plants.

What Is Plant Capacity

What determines the capacity of a plant? The physical plant may be roughly divided into four classes of property: (1) Source of supply, (2) treatment facilities, (3) high duty pumping, and (4) distribution system.

Assume that source of supply is unlimited (not always a safe assumption). The building of additional treatment, if required, and added high duty pumps, is a simple matter, although costly. Particularly costly when such additions are made to take care of demands that last only three or four months in the year and then lie idle for the remaining eight or nine months. Assume the water rates are adequate to permit this type of capital expenditures, the question may still be why worry. But what about the distribution system?

What about the distribution system?—Too little thought has been given to this class of physical plant in relation to the problem. Most distribution systems have been sized to supply, adequately, all ordinary demands, plus fire demands. The only reason why some systems have been able to absorb the air conditioning load is because they have been fortunate in not having to serve water for the extinguishment of a fire coincident with air conditioning demands.

Fire Fighting Capacity Wrongfully Used

It has been that capacity of the distribution system designed for fire fighting that has furnished sufficient water for air conditioning over and above normal usage. Is it not better to prevent such a situation before it happens than, when it does confront the utility, to attempt to get water reuse devices installed or to institute a program of distribution system reinforcement to handle such a short seasonal load?

This sort of situation is not as far fetched as you may think. I know of one municipality where they have an agreement with their customers that when the fire alarm is sounded, air conditioning systems are turned off.

The easy way to prevent this sort of thing from happening is to pass an ordinance or adopt rules and regulations prohibiting water use in air conditioning unless in connection with some type of water reuse device. But is this the best way? I do not think it is.

AWWA Committee Recommendations

Under pressure from the AWWA membership, the AWWA committee that studied the situation, developed a model ordinance to be used for guidance, if prohibitive measures were to be instituted. In submitting this proposed model ordinance, the committee stated that in their opinion the only equitable method of control was through the institution of a demand charge. I believe this recommendation was made seven years ago and although the committee is still active, to my knowledge, there has been no change made in that recommendation. I am in complete agreement with their recommendation.

The Demand Charge is Equitable

A demand charge denies the customer nothing. The water is there if he wants it and will pay for it, (demand charge plus usage). Or if he wants to put in a water tower, he will pay no demand charge—only for water used and that will be 90 to 95 percent less than if he did not have the tower. Economics will immediately dictate that he install the water tower. His savings in water will pay the added power bill, take care of depreciation and maintenance, and still leave dollars in his pocket.

Of course, he can install an air-cooled condenser and that will be of no concern to the water utility. The only pipe in such an installation is from the unit to discharge the moisture removed from the air during normal operation. This is a surprising amount in humid climates. I have seen them discharge a steady stream of water.

Let us assume the customer chooses to pay the demand charge plus water usage. If the demand charge has been properly computed he will be paying a sufficient amount so that his account is economically self supporting. Without the demand charge he is not and thus he becomes a liability, not only to the water utility, but to all other water users as well, for they will be supporting his uneconomic demands in the rates they pay.

It's Time to Think About the Problem

If you have taken no steps to meet this coming demand, I suggest you get busy and figure out a proper demand charge and see that the proper authorities approve it. You will not be the one to break the ice. Four public service commissions (Arkansas, Missouri, Illinois, and Wisconsin) have already approved such a rate for air conditioning. Several municipalities, not under public service commission jurisdiction have already adopted the demand charge by ordinance. Several papers in the November 1955 issue of the AWWA Journal will give you methods by which to compute the charge.

You may wonder why I bring this to your attention. Frankly, I want to create more interest in this problem, because, in my contacts in the field, I fail to detect any real attempt to anticipate the coming demands. Too many water works men are just waiting until the load hits them and then will wring their hands in amazement. What I am saying now is—Think it over,—yes think it over carefully.

Yours, Clif

WELL PLACED and well spaced equipment makes meter shop highly efficient.

Meter Maintenance at Utica, N.Y.

Vastly improved in a new meter shop

by JOHN P. SCHMIDT

Mr. Schmidt is Meter Shop Foreman at Utica, N. Y. This paper on meter maintenance practices, presented as part of the "Water Works School" of the N. Y. Section of AWWA, has been released by the Association for publication in Water & Sewage Works.

THE NEW METER repair and testing shop of the Utica Board of Water Supply is a much more efficient, up-to-date, and better place to work in than the one previously used. The former meter shop was located in the basement of the main office building. Here the windows were small, which allowed only a minimum of daylight to enter, making it necessary to use artifical light most of the time. The small amount of floor space provided made it impractical to plan for any future expansion of meter repair work.

Enlarged meter testing space was necessary, because of the continual increase in the number of meters in the system. In the old meter shop it was very inconvenient for more than one man to test the various sizes of meters at one time. This was due to the fact that there were three different meter test benches and only three tanks of various capacities into which water was run while testing at the various rates of flow.

The location of the present shop is in the new one-story building, part of which is used as a garage, a hydrant repair department, and offices for a construction superintendent and his foremen. The meter shop, set up in one large room of this building, has a floor area of 53 ft. by 32 ft. which is approximately one third larger than the old meter shop. It is equipped with large industrial-type windows providing ample natural light.

New steel work benches are located in front of the large windows and provide space for five men to work. The layout of this meter shop was planned with equipment arranged in a manner whereby work would move efficiently and systematically from test to storage, with a resulting saving of time in the repair and testing.

Testing Facilities

Directly opposite the repair bench is a 10-meter hydraulically operated meter test bench for ⅝-in. meters. At the outlet end of this test bench are two calibrated tanks, one with a 10-cu ft capacity and the other of 1-cu ft capacity. These tanks are equipped with electrodes that shut off the water at the exact point required on the volumetric scales. This method of control does away with in-

accuracies that could occur when the water is shut off manually. With this arrangement of testing the smaller meters, it is now possible to test small meters continually without interruption of other testing.

On the opposite side of the shop from the work benches is located the testing equipment for the larger meters. This consists of another hydraulically operated bench for testing meters ranging in size from ¾ in. up to and including 2 in. Adjacent to this bench the necessary piping and valving has been assembled for testing meters from 3 in. to 8 in. in size.

The piping from these test benches is arranged so that water from them can be run into any one of the three test tanks, whose capacities are 100, 10, and 1 cu ft respectively. The small tanks are also equipped with electrodes for automatic shutoff of the water at the correct time. A rate of flow indicator is mounted on the front of one of these tanks, making it possible to adjust the rate of flow through the meters being tested.

A steel track and hoist have been conveniently installed overhead in the shop, so that the larger meters can be set up in either one of these test benches or moved from one end of the room to the other by one man. The necessary meter storage, parts, and tool cabinets have been conveniently arranged in the room for easy access.

Testing Schedule

The cost of the meter shop was $13,800, which includes the concrete floor, asphalt tile, and underdrain system.

THE AUTHOR (right) explaining to Commissioner Sunderhaft some features of the modern household water meter.

A scheduled routine of meter repairing and testing has been established on a yearly basis whereby ⅝ and ¾ in. meters are changed for testing and repair after having been in service for ten years or after they have shown a registration of 100,000 cu ft. For 1 in. meters the time is five years or 150,000 cu ft, and for 1½ and 2 in. compound meters, every four years or 400,000 cu ft. The 1½ and 2 in. disc-type meters are kept in service until they show a registration of 1,000,000 cu ft or every four years. All meters over 3 in. in size are usually tested and repaired in place during the warmer months of each year. In addition to this work, meters that have stopped or have been broken are taken care of as soon as they are found.

Meter testing specifications require registration of not less than 98 percent or more than 101 percent on any of the test rates of flow over ¼ gpm or ⅝ to 1 in. meters.

The meter shop has been able to repair and test approximately 200 meters of various sizes in a month. They consist of stopped meters, routine tests, and those that have been broken. This work is handled by a staff of five workmen, each of whom has a particular job to perform. Usually one workman changes meters. The duties of another consist of making out the necessary change and repair tickets and the testing of all of the meters up to 1 in. in size. Another man disassembles and cleans these meters so that the necessary repairs can be made by one or two repairmen. The larger meters (ranging from 1½ to 8 in. in size) that are brought into the shop, are cleaned, repaired, and tested by one man. After all the necessary repairs have been made, they are tested and the registers are set at zero, the meters are sealed and painted. Convenient cabinets provide space for storage of repaired meters.

Acknowledgment

For the opportunity to present this report on Utica's new meter shop and meter maintenance practices, the author wishes to express his appreciation to Mr. Dennis P. O'Dowd, General Manager of the Utica Board of Water Supply, and to Commissioner Louis G. Sunderhaft.

TWO-UNIT test bench for 1½- and 2-in. meters.

TEN-UNIT test bench for 1-, ¾-, and ⅝-in. meters.

The Water Supply of Caesarea

Ancient Mediterranean city used aqueducts from springs that have once again been put to use.

by JOSEPH M. DENNIS

Mr. Dennis is now Asst. Chief Sanitary Engineer for the United States of America Technical Co-operation Mission to India in New Delhi. Prior to this assignment he was Sanitary Engineering Advisor to the Ministry of Health in Israel, at which time he wrote this article.

THE RUINS of the ancient city of Caesarea with its aqueduct lies on the Mediterranean Sea Coast of Israel some thirty miles south of Haifa.

Nearly 2000 Years Ago

In the year of 22 B. C., King Herod the Great began to build a magnificent city as a deep sea water harbor at a point which was called "Strato's Tower" after the King of Sidon. Herod wanted a city that would bring favor to him in the eyes of the Roman Emperors.

This city was named Caesarea for Augustus Caesar; it was said to have been built in the short span of twelve years. At one time its total population consisted of 50,000 persons, by far the largest city in all Palestine. Its general location is indicated in the accompanying map sketch (Fig. 1).

In order to make a sheltered port for the ships from Rome to unload their cargoes, huge stones were sunk 30 feet in the sea to support the 60 meter wide breakwater. Black and red granite columns from Asswan, Egypt, were used to reinforce the masonry construction (Figure 2). Parts of this old sea wall have been incorporated into the fishing schooner port of a small, present-day settlement in the area.

The walled city itself consisted of beautifully laid out streets, palaces, gardens, public baths, out-door theaters and a 20,000-seat hippodrome which was used for the public games similar to those held in the Colosseum at Rome.

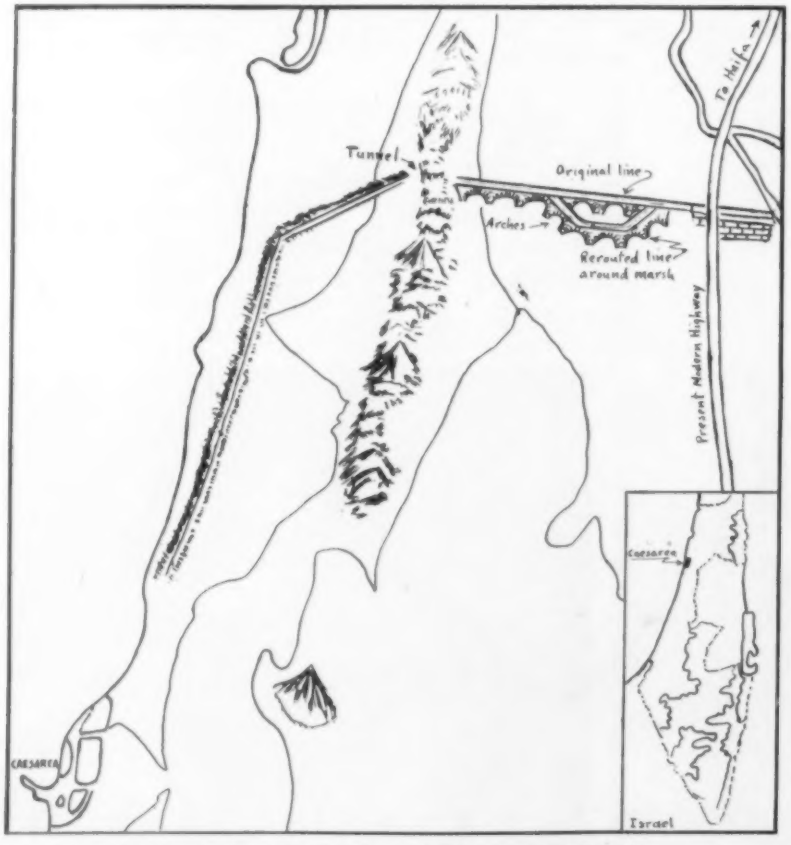


Fig. 1—SKETCH map of area showing aqueduct location
Insert shows location of Caesarea in Israel

Sewers and Aqueduct

Flavis Josephus (93 A.D.), a prolific writer of those days, tells of drains for carrying rain water and filth from the people to the sea (Fig. 3). Further he describes the bringing of water to the city from "a great distance as the city was destitute of water" (Fig. 4). Apparently the city was growing so fast that the people could no longer depend upon shallow wells and cisterns for their municipal water supply; a problem which has a familiar ring to the public works officials of today.

To insure the survival and growth of the city, they must have instructed the civil or military engineers to bring the necessary water to the city regardless of the tremendous expense and effort involved.

The engineers were successful in finding an ample water supply of a good quality in the spring which forms the head-waters of the Zarka River, some 4.5 miles north-east of the city. There is no record of the

output of this spring in those days. The writings of Sextus Frontinus (40-103 A.D.) in Rome and studies of his aqueducts by Clemens Herschel indicate that the engineers of that day did not understand the relationships of cross sectional area, slope, velocity, roughness, etc. as they affect the flow in open or closed channels. A gauge, however, established in 1943 on the Zarka River gives the following typical flow pattern, shown in Table 1.

TABLE 1

Flow from Zarka Springs—1942-43

Discharge in cfs.

Month	cfs
Oct.	13.4
Nov.	13.8
Dec.	28.0
Jan.	80.0
Feb.	64.0
Mar.	62.0
Apr.	35.5
May	23.4
June	20.4
July	20.4
Aug.	18.2
Sept.	16.8

That the water was fairly hard is indicated by the calcium carbonate deposits along the old aqueduct. Recent analyses of the Zarka spring water (Table 2) confirm this indication of high calcium carbonate content.

Other analyses indicate that the pH may at times be as high as 8.0 and the hardness and chlorides may go as high as 516 ppm and 245 ppm respectively.

The pH of the October 13th sample did not change after standing overnight with powdered calcium carbonate. A Langleir index determination further indicated that the water as it comes from the ground is neither corrosive nor would it produce deposits of calcium carbonate in the water conduits.

Fig. 2—SEA WALL of ancient Caesarea

Note granite pillars used to reinforce masonry walls: they were quarried and shaped at Asswan 600 miles up the Nile River from Cairo

It can be seen from Fig. 5, however that when carbon dioxide was released from the water as it cascaded over the edges of the aqueduct, calcium carbonate was thrown out of solution and huge stalactites were formed.

TABLE 2

Analysis of Zarka Spring Water

10/13/55

Chemical	ppm	
Carbon dioxide—CO_2	31	(as $CaCO_3$
Bicarbonate—HCO_3	249	(" ")
Total Alkalinity	280	(" ")
Hardness	275	(" ")
Calcium—Ca	80	
Chlorides—Cl	181	
Total solids	700	
pH	7.3	
Temperature	24.5°C	

Thick layers of calcium carbonate deposits can be seen over the entire length of the open sections.

Constructing the Aqueduct

After the selection of this water source, the aqueduct was started in earnest. Stones were quarried from an area some 3.5 miles north of the city by large numbers of slaves. It is not known when the aqueduct was actually started, but a stone described by Zev Vilnay bearing the Latin inscription "Imperator Caesar traianus Hadrianus Agustus Fecit perveillationem Legionis X Fretensis" is the same type as that found in the Church at Abu Ghosh. This inscription of Hadrian (117-138 A.D.) is well known as that of the Tenth Roman Legion. The author spent many un-

Fig. 3—ARCHED construction of combined sewer not unlike that used today

Fig. 4—RUINS of ancient water aqueduct from Zarka spring to Caesarea

Fig. 5—STALAGTITES formed along old aqueduct
Release of CO_2 during aeration allowed deposition of calcium carbonate

Fig. 6—PART of aqueduct enclosed in clay pipes
Historians disagree as to whether this was part of original construction or built later

successful hours looking for this stone along the aqueduct but it must have been removed by vandals or archeological experts. Its whereabouts may be known to others.

As near as one can ascertain, the aqueduct's intake structure raised the water level of the spring to an elevation of some 46 feet. This was effected by the construction of a low head dam, at the coordinated E 144.4-N 215.3, and cutting a channel in the stone at the toe of the southern slope of the Carmel range of hills. Today it appears that the first 3300 feet of this aqueduct, though raised on stone piers, was closed in by three 10 inch clay pipes. The clay pipes were encased in masonery which may have permitted parts of them to lie above the hydraulic grade line (Fig. 6). (Rouse, in his "History of Hydraulics", indicates that the principle of the syphon was well known to the artisians of that day.)

Fig. 7—SECTION of aqueduct almost completely covered by drifting sand

Some 600 feet west of the north-south Haifa-Tel Aviv highway, the aqueduct starts in open channel at an elevation of 37 feet and proceeds west on raised stone arches some 3500 feet up to the edge of a 95 foot hill. Here the aqueduct is in tunnel for 1100 feet. It then comes out on the west side of the hill and proceeds southwest in open channel for some 2800 feet, from whence it turns in a southerly direction to the ruined city of Caesarea. This part of the aqueduct, which is nearly covered with drifting sand (Fig. 7), is some 10,000 feet long and ends at an elevation of 19.0 feet, which indicated that the entire aqueduct had an average slope of only 1.3 feet per 1000.

About 1500 feet of the lower end of the aqueduct is missing as the shore line has changed considerably during the last 1000 years. When the aqueduct appears again near the city, it is running almost due east and west and is covered (Fig. 8). Until more extensive excavations are made at Caesarea one is not able to determine the direction of the flow at this point. Huge quantities of water were required for the public baths in the harbor area in addition to that used in the drinking fountains. There are numerous small take-off clay pipes protruding from the high banks in the northern part of the city. Several sections of these pipes can be seen at the Graduate School of Engineering at Harvard University, and show how the pipes were joined by a calcined limestone and ash mixture.

Problems of Maintenance

It has often been pointed out to the layman that the engineers of the Roman era are even today unsurpassed. Of course, the only examples of their efforts we see are those which have not failed. Without trying to discredit our predecessors and realizing that we have benefited much from their experiences, it can be readily seen that these men did not thoroughly understand the principles of foundations and soil mechanics.

All along the aqueduct it is apparent that the water was continually flowing out of the channel due to the excessive settling of the entire structure. It had to be reinforced and raised a number of times to bring the flowing water nearer to grade.

The water spilling over the aqueduct and the damming of the Zarka River near its mouth for irrigation purposes created a swamp which surrounded the center of the east-west section of the aqueduct. This made matters worse until the sixth century when the water stopped flowing in the fountains of Caeserea, and the aqueduct had to be re-routed south around the engulfing swamp, (see Fig. 1).

In 985 A.D. a geographer stated that the drinking water in Caeserea had to be taken from wells and cisterns which means that the aqueduct was probably not in continuous use at that time. A "Hugo" of Caeserea reports in 1166 A.D. that the aqueduct has stopped functioning entirely.

Modern Use of Zarka Springs

There seems to be no record of the use of the Zarka River spring as a

Fig. 8—COVERED aqueduct where it entered city
Reason for cover probably to prevent pollution and unauthorized access

Fig. 9—COLLECTING trenches and springs at Zarka for modern water supply of Benyaminia
Pumping station in rear

municipal water supply from the 12th century until the establishment of the Jewish State of Israel. In 1953 local officials started cleaning the blackberry briars from the spring area and drew up plans for placing perforated collection pipes from the many small springs to a central pumping station (Fig. 9). Today the water is being used in the modern agricultural settlement of Benyamina where, with other ground water supplies, it replenishes the "public fountains" and satisfies the thirst of hundreds of people as it did in the days of Herod the Great.

References:

(1) Jewish Antiquities—Flavis Josephus
(2) Ticket to Israel—Shepard and Rosenfeld
(3) Excavations at Caesarea Maritina—S. Yeivin
(4) Short Guide to the Ruins of Caesarea—Ministry of Education & Culture (Israel)
(5) Palestine Exploration Fund—(1927/8)
(6) Israel Exploration Journal—(1950/51)
(7) History of Hydraulics—Rouse & Ince

New Standards on Flexible Polyethylene Plastic Pipe

Users of plastic pipe now have a new additional yardstick by which they can measure quality plastic pipe. The United States Department of Commerce has issued a new commercial standard of Flexible Polyethylene Plastic Pipe. After review by the U. S. Bureau of Standards, with the cooperation of the Polyethylene Pipe Standards Committee of The Society of the Plastics Industry, the revised CS 197 was developed and submitted to the industry for approval. This approval has now been obtained and the Revised Standard, known as CS 197-57, Flexible Polyethylene Plastic Pipe, is effective as of April 15, 1957.

One of the major revisions in this commercial standard is the new requirement that "all pipes shall meet the specifications of the National Santation Foundation. These specifications require that the pipe shall be manufactured of virgin polyethylene, that no scrap material has been used, and that it is satisfactory for potable water."

The requirements of the National Sanitation Foundation were arrived at after four years of testing by this organization which is headquartered at the School of Public Health at the University of Michigan. Upon completion of this testing which was sponsored by pipe manufacturers and pipe raw material manufacturers who are members of the Society of the Plastics Industry, standards were established on the manufacture of plastic pipe that is suitable for drinking water.

Plastic pipe meeting these specifications may be labeled as "NSF Approved for Drinking Water." The complete results of the NSF's testing are available in a report titled, "A Study of Plastic Pipe For Potable Water Supply."

Copies of CS 197-57 are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 5, D. C. for 10¢ a copy. Copies of NSF's "A Study of Plastic Pipe for Potable Water Supply" are available from the Society of the Plastics Industry, 250 Park Avenue, New York 17, for $1.00 a copy.

Erie Honors Johnson and Papesch for a Century of Combined Service

A most unusual celebration was staged in Erie, Pa. when Mayor Gardner of Erie proclaimed April 29, 1957 as "Jack Johnson and George Papesch Day" at a testimonial dinner in honor of these two water works men. The dinner was attended by 300 persons, including Mayor Gardner, all five members of the City Council, the City Treasurer, the Comptroller, and all Dept. Heads.

The occasion was the completion of 50 years of service to the city by Jack Johnson Sup't. of Water and by George Papesch, Ass't. Sup't., neither of which is being retired, but rather honored for "a century of combined service" with more of the same to follow.

The proclamation read by Mayor Gardner follows.

PROCLAMATION

WHEREAS the officials and citizens of the City of Erie are cognizant of the service records and accomplishments of their public servants; and

WHEREAS meritorious services rendered by city employees makes for economy in government and good public relations; and

WHEREAS the City of Erie has been fortunate in having Jack Johnson and George Papesch who have excelled in the administration of their office and assignments; and

WHEREAS Jack Johnson and George Papesch are completing 100 years (combined) of distinguished, faihtful and devoted service with the Bureau of Water, City of Erie; and

WHEREAS said service records of Jack Johnson and George Papesch merit the respect and commendation of the officials and citizens of the City of Erie.

NOW, THEREFORE, it is with extreme pleasure as Mayor of the City of Erie, that I do hereby proclaim April 29th, 1957 as "Jack Johnson and George Papesch Day".

Arthur J. Gardner, Mayor
City of Erie

Given under my hand and seal
this 29th day of April, 1957.

WATER WORKS PRACTICES

Corrosion—II

Contributing Factors, Protective Coatings, Materials

The previous installment in this series presented the causes and theory of corrosion. Not included was a section on factors which contribute to corrosion. This section appears here, prior to the discussion of methods of controlling and prevent corrosion.

by GEORGE E. SYMONS, Ph D.

In this series, Dr. Symons discusses water works practices in the form of short school lectures, designed to assist operators, students, and others who wish to review fundamentals in this field.

D . . . Contributing Factors

1 . . Dissolved Gases

a. The greater the dissolved oxygen content of water, the more effective it is as a hydrogen acceptor and therefore, the greater the effect on corrosion.

b. Carbon dioxide in water tends to lower the pH; i.e., to increase the hydrogen ion concentration and thereby to increase the tendency of metal ions or alkaline protective coatings to go into solution.

c. Hydrogen sulfide in waters is slightly acidic; it can be utilized by bacteria and oxidized to higher acids which are more corrosive. It can also react with ferrous iron to produce ferrous sulfide.

d. Chlorine, present as either free residual chlorine or combined residual chlorine (particularly the monochloramine) will react with ferrous iron to oxidize it to the ferric state. While the amount of chlorine is small, its presence will contribute to the tendency of iron to go into solution.

2. . Bacteria

a. Sulfate reducing bacterial in water will produce hydrogen sulfide which will react with iron, to produce ferrous sulfide.

(1) One theory is that hydrogen polarization of the cathodic areas of iron, under anaerobic conditions, is depolarized by the action of sulfate reducing organisms, with this cathodic hydrogen being used by the bacteria to reduce the sulfate ion to hydrogen sulfide which reacts with ferrous iron to precipitate ferrous sulfide.

(2) Anaerobic conditions may exist in the interior of water mains, beneath the surface of biological slimes or in the interior of tubercles.

b. External corrosion of iron pipe may also result from the same cause.

3 . . Temperature

a. Temperature of the water and the metal plays an important part in corrosion, whether the action be biologically caused or strictly electrochemical in nature.

b. The higher the temperature the greater the rate of corrosion.

4 . . Hydrogen Ion Concentration

a. Since the cathodic reaction of corrosion involves the addition of electrons to hydrogen ions to produce hydrogen gas, it is to be expected that the greater the hydrogen ion concentration, the greater the extent to which this reaction will occur.

b. Hydrogen ion concentration, being inversely related to pH, it follows that the lower the pH, the greater the corrosive activity.

c. Eliassen and co-workers—JAWWA, 48: 1005(1956)—have developed a curve showing the relation of corrosion rate to pH (See Fig. 3).

(1) According to these researchers, "the corrosion rate decreases with time and follows an exponential law derived from the equation

$$C = K(1 - e^{kt})$$

where: C = total corrosion
K = constant of same units as C
k = constant which is reciprocal of time
t = time after corrosion begins"

(2) The corrosion rate finally reaches an almost constant low value and does not cease with time.

5 . . Velocity

a. The experiments of Eliassen (ibid.) indicate that the velocity of moving water plays a part in the rate of corrosion.

(1) The initial rate for any pH is proportional to velocity and is a function of velocity to a fractional power of about 0.8.

(2) The effect of velocity is related to the laminar sublayer of water existing under different rates of flow and depends to some degree on the roughness of the surface and the turbulence of flow.

b. The effect of velocity on corrosion rates must be correlated with the physical and chemical characteristics of the corrosion products under each pH condition. (See same article by Eliassen, et al).

6 . . External Environment

a. In the case of buried pipe, etc., the characteristics of the soil have an important bearing on corrosion.

Ed Note; Dr. Symons is Exec. Vice Pres. and Editorial Director of the Scranton Publishing Co., Inc.

(1) Of particular importance is the pH of the soil and the presence or absence of sulfur compounds, etc.

(2) Also important in corrosion of surfaces submerged in water or buried in soil is the bacterial environment.

b. Stray electric currents in respect to buried metal structures, pipe, etc. may have an important effect on the rate and extent of corrosion.

c. Atmospheric pollution, in respect to structures above ground, is a factor in corrosion of these structures.

E . . . Corrosion Control

1 . . Purposes

a. To interrupt or prevent the occurrence of anyone of the basic steps in the corrosion reaction (anodic reaction, cathodic reaction, depolarization, and reaction of metal ions).

b. To maintain water quality.

c. To prevent loss of carrying capacity of distribution systems.

d. To reduce operating costs

2 . . Methods of Control

a. Non-corrosive materials
b. Protective coatings
c. Insulation
d. Deactivation of water
e. Chemical treatment of water
f. Cathodic protection

F . . . Non-Corrosive Material

1 . . Metals

a. So-called non-corrosive metals either possess a low solution potential or the corrosion product is a dense oxide which acts as a protective coating.

(1) Stainless steel, monel metal, tin, and copper are examples.

(2) These metals are usually too expensive except for special uses.

b. For service connections, interior, and other small piping installations, these metals may be used: copper, brass, lead, tin, monel metal, stainless steel, silicon bronze, and nickel-molybdenum-chromium-iron alloys.

(1) Copper should not be used in very soft waters containing large amounts of carbon dioxide; tin lined copper is preferable.

(2) Lead, likewise, should not be used in soft waters because of the toxicity of lead salts; it can be used in hard waters.

c. Red brass (containing 85 per cent or more of copper) is highly resistant to corrosion.

(1) Alpha brass (67 per cent copper) is fairly resistant to corrosion.

(2) Brass containing 60 per cent or less copper will dezincify in soft waters.

d. Everdur metal (copper and silicon) in various compositions is effectively used for tanks, gates, weirs, screens, bolts, tubing, conduits, etc.

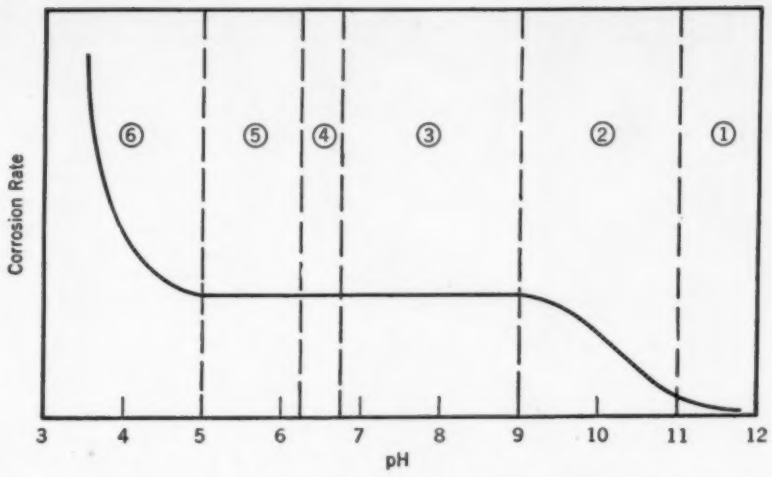


Fig. 3 Corrosion control as a function of pH (After Eliassen, et al)

Conditions governing the rate of corrosion at various pH ranges are indicated by numbered hypothetical zones. Thus, in Zone 1, the rate of corrosion would be controlled by anodic reactions; in Zone 2, by mixed anodic and cathodic reactions; in Zone 3, primarily by cathodic reactions; in Zone 4, partially by anodic reactions (as indicated by serious pitting); in Zone 5, by cathodic reactions (as indicated by oxygen depolarization); and in Zone 6, by cathodic reactions (as indicated by oxygen depolarization and hydrogen evolution).

2 . . Non-metals

a. Non-metallic materials are poor conductors of electricity and will resist attack.

b. Wood, reinforced concrete, asbestos-cement, fiber, plastic and glass have all been used for pipe lines and other uses.

(1) Wood stave pipe finds its greatest use in aqueducts, particularly for power plant penstocks.

(2) Reinforced concrete pressure pipe is increasingly used for large water mains.

(3) Asbestos cement pipe is available for water mains and has found wide acceptance.

. . . It will withstand salt water and soft corrosive waters, but not acids.

. . . When first installed, it is subject to a slight leaching action and both the alkalinity and hardness of the water are increased slightly. This difficulty has been overcome to a large extent and the effect is not only minimized but lasts for a relatively short time.

c. Synthetic plastics have been successfully used for both service connections and household piping.

(1) When used in acid soil, plastic service lines have shown no deterioration over a period of seven years.

(2) Plastic pipe, likewise, is unaffected internally and does not corrode, tuberculate, or lose carrying capacity.

3 . . Special Materials

a. For conveying acids, or other highly corrosive substances, special materials are often needed.

b. Among the most commonly used are rubber, Duriron, lead glass and fiber.

G . . . Protective Coatings

1 . . Function

a. Coatings are used to interrupt both anodic and cathodic reactions. The escape of cations is prevented and contact of the metal with water and oxygen is also prevented.

b. Coatings are effective in corrosion control both internally and externally in pipe, tanks, etc.

2 . . Non-metals

a. Paints.

(1) Paints are used effectively for the protection of structures against atmospheric corrosion, but are not very effective against underwater or underground corrosion.

(2) Paints for water works structures subjected to submergence generally have asphaltic or bituminous bases, often applied over a coat of red lead.

(3) Paints and lacquers used in connection with cathodic protection must be alkali resistant because alkali is produced at the cathode.

(4) Paints for protection of metal often employ metallic pigment, quite frequently, zinc or lead, mixed with linseed oil.

(5) Aluminum paint is quite popular for elevated tank storage, not only

because of its effective protection, but also because of its appearance.

b. Asphaltic or bituminous linings and coatings.

(1) Bituminous materials have a long history of successful use particularly for cast iron and steel water mains.

(2) These coatings are made from natural asphalt or coal tar pitch.

(3) Methods of applying these coatings include:

. . . Dipping in a bath of hot tar.

. . . Applying molten coating centrifugally inside and brushing it on the outside.

. . . Steel pipe may also be wrapped with asbestos felt saturated with bitumens.

. . . AWWA Specifications C102-39, C203-51, and C204-51 include asphaltic coatings.

(4) Asphaltic protective coatings will vary with the diversity of materials available and are less permeable to oxidizing agents than to water.

(5) Asphaltic enamels are equal to or superior to other bituminous coatings.

c. Cement linings or coatings.

(1) Cement linings are used for both iron and steel pipe.

(2) The cement lining consists of a 1:3 mixture of Portland cement.

(3) The thickness of the lining used depends on the pipe diameter.

4 to 12 in. — ⅛ in. thick
14 to 24 in. — 3/16 in.
30 to 48 in. — ¼ in

(4) Lining at the factory is applied centrifugally.

. . . The thickness of the lining is tapered slightly for a distance of 3 inches at each end.

. . . Cement linings may be cured by applying a bituminous seal coat or by storage in moist air.

(5) Lining in place can be done effectively after rust and tubercles are removed by cleaning the mains.

. . . For small mains, 4 to 14 inches in diameter, the Tate Lining Process is used; it employs a mandrel pulled through the pipe into which the cement mortar is placed.

. . . For pipes from 16 to 48 inches, the Centriline Process is used; it employs a machine which coats the inside of the pipe centrifugally and trowells it mechanically.

. . . Most cement linings in place are from 3/16 to ⅜ inch in thickness.

. . . Lining with cement does not introduce any problems for making service connections.

(6) Cement linings have a slight temporary effect on the quality of the water, increasing the alkalinity and the hardness, but the effect does not last.

. . . Acid waters will attack cement linings.

(7) Cement lining is not completely impervious to water but water that penetrates the lining forms an alkaline solution in contact with the iron and tends thus to inhibit corrosion.

(8) AWWA Specifications C104-39 and C205-41 includes cement linings for cast iron and steel pipe.

d. Enamels, Resins, and Mastics.

(1) Vitreous coatings are made from molten silicate discharged into water, then ground with clay and water; this mixture is then applied by dipping or brushing, after which the item is dried and baked to form the enamel. (This type of coating is not used in pipe).

(2) Special coatings for pipe have been developed to remain sufficiently flexible to prevent cracking at low temperatures and still exhibit resistance to cold flow.

. . . These are termed modified or plasticized enamels and are used particularly for external coatings of pipe subjected to corrosive underground conditions.

(3) Resins are obtained from the exudation of various plants; when applied to metals they sometimes are termed lacquers.

(4) Synthetic thermosetting and thermoplastic resins are also used.

. . . The metal is cleaned and covered with resins (by spraying brushing or dipping) after the solvent evaporates the coating is baked on.

(5) Mastics, for protection against underground coil corrosion, are coatings composed of graded sand, limestone dust, asbestos fiber, and a bituminous binder.

. . . These coatings are heated for application and installed on primed pipe, using special equipment developed for extruding the mastic around the pipe.

. . . These coatings are usually quite thick and upon cooling form a hard coating that has a good resistance to soil stress and moisture penetration.

. . . There are some disadvantages to this type of coating (extra materials, increased weight, skill required to patch, etc.) and they are seldomly used in water works practice.

e. Synthetic plastics as extruded linings or otherwise applied have not progressed beyond the research stage at this time.

3 . . Metals

a. Zinc is the most common metal protective coating and lining for iron.

(1) It is anodic to iron and is intended to be consumed; its life expectancy should not be too long.

. . . The lining must be continuous and free of holidays, or local galvanic cells will be set up.

(2) Hot dip galvanizing is the most common method of applying. The metal is first pickled to remove rust and then dipped in molten zinc.

(3) Zinc coating may be applied by electroplating.

(4) Sheradizing is another method of galvanizing; the hot iron is revolved in a drum with zinc dust.

b. Aluminum may be applied by "calorizing", a process similar to Sheradizing.

c. Tin or lead is applied similarly to hot dip galvanizing (but lead linings should not be used in soft water).

d. Nickel and copper may be applied electrolytically.

e. Copper coated steel forms an alloy that is soft, ductile and flexible.

f. Processes which alter the surface of the iron (Parkerinzing, Bonderizing, anodizing, etc.) produce moderately corrosion-resistant films of iron oxides or phosphates on the surface.

g. Metallizing consists of spraying a coat of metal on the surface of the metal to be protected.

(1) The method consists of passing a wire through a flame and blowing the molten metal (by an air blast) in a fine spray onto the surface.

(2) The method requires careful surface preparation, proper metal selection, as well as care in application.

(3) Metallizing finds its greatest application in building up eroded or corroded surfaces of equipment. It is not used for coating water lines.

4 . . Natural Coatings

a. Under certain conditions, coatings are formed naturally on surfaces in contact with water.

b. These coatings may be deposits of mineral coatings.

(1) Calcium carbonate or silicate due to the presence of those substances in the water.

(2) Oxides, hydroxides, carbonates, basic carbonates, silicates, etc. of the metals produced by the reaction of dissolved metals with these substances in the water.

(3) Such coatings may decrease the rate of corrosion or even stop it.

c. Organic slimes may retard corrosion, but they may also aggravate it as indicated heretofore.

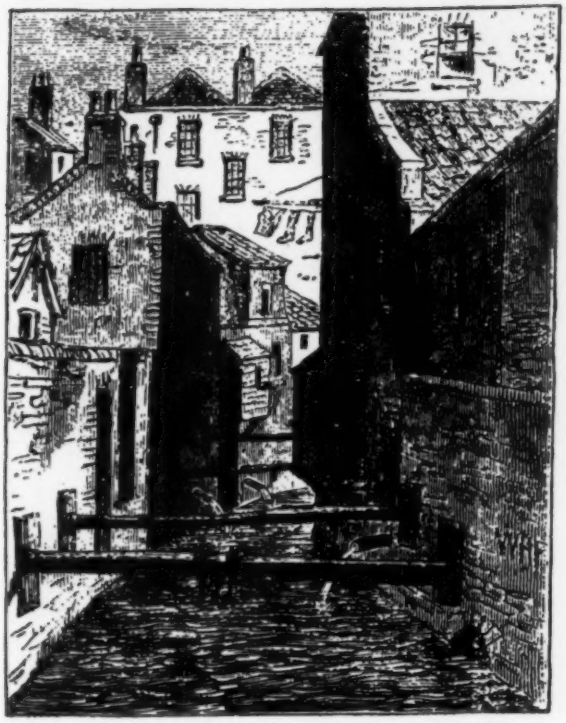
d. The production of natural coatings is one of the purposes of chemical treatment for corrosion control. This subject will be discussed later.

(Ed. Note: The next installment in this series will discuss other methods of corrosion control—Insulation of metals, deactivation of water, chemical treatment and cathodic protection. Reference sources will also be included.)

Then

And

Now



IN 1844, sewage outlets discharged directly into the River Fleet

At London County Council Southern Outfall Works

by JOSEPH RAWLINSON, C.B.E.

Mr. Rawlinson is Chief Engineer of the London County Council, London, England. In this article he reviews both the history and present plans for betterment and enlargement of a sewage treatment plant which has been serving London for 91 years.

THE LONDON COUNTY Council is preparing to construct sewage-treatment works as an extension of the Southern Outfall Works at Crossness, Erith, in the County of Kent. These proposed new works will be of considerable interest both from the point of view of their magnitude and the fact that they will represent the latest developments in English practice.

The project is also interesting in that it forms the culmination of a century of sewerage work in London, for it was on 4th April, 1865, that the original Southern Outfall Works were opened by His Royal Highness the Prince of Wales (later King Edward VII) (See Fig. 1) and the four James Watt beam engines installed to pump the sewage were named "Victoria", "Prince Consort", "Alexandria" and "Albert Edward".

A Long Time Ago

Just how long ago this was will be appreciated when one is reminded that it was in this year of 1865 that General Lee surrendered to Grant, and Abraham Lincoln was assassinated. It was a time when in England ironclad fighting ships were a novelty; soldiers were still equipped with muzzle-loading rifles, and naturally, sanitation (in the modern sense of the term) was in its infancy. Yet parts of the Northern Outfall Works at Beckton and the Southern Outfall Works at Crossness are still in use and will be embodied in the works in hand at the former and proposed at the latter.

The four original 164 hp beam engines driving single acting ram pumps each 125 (U.K.) tons per minute capacity still remain at the Southern Outfall Works (See Fig. 2) but are not now in service. An engineering magazine recently "shed a valedictory tear" for them, stating that there

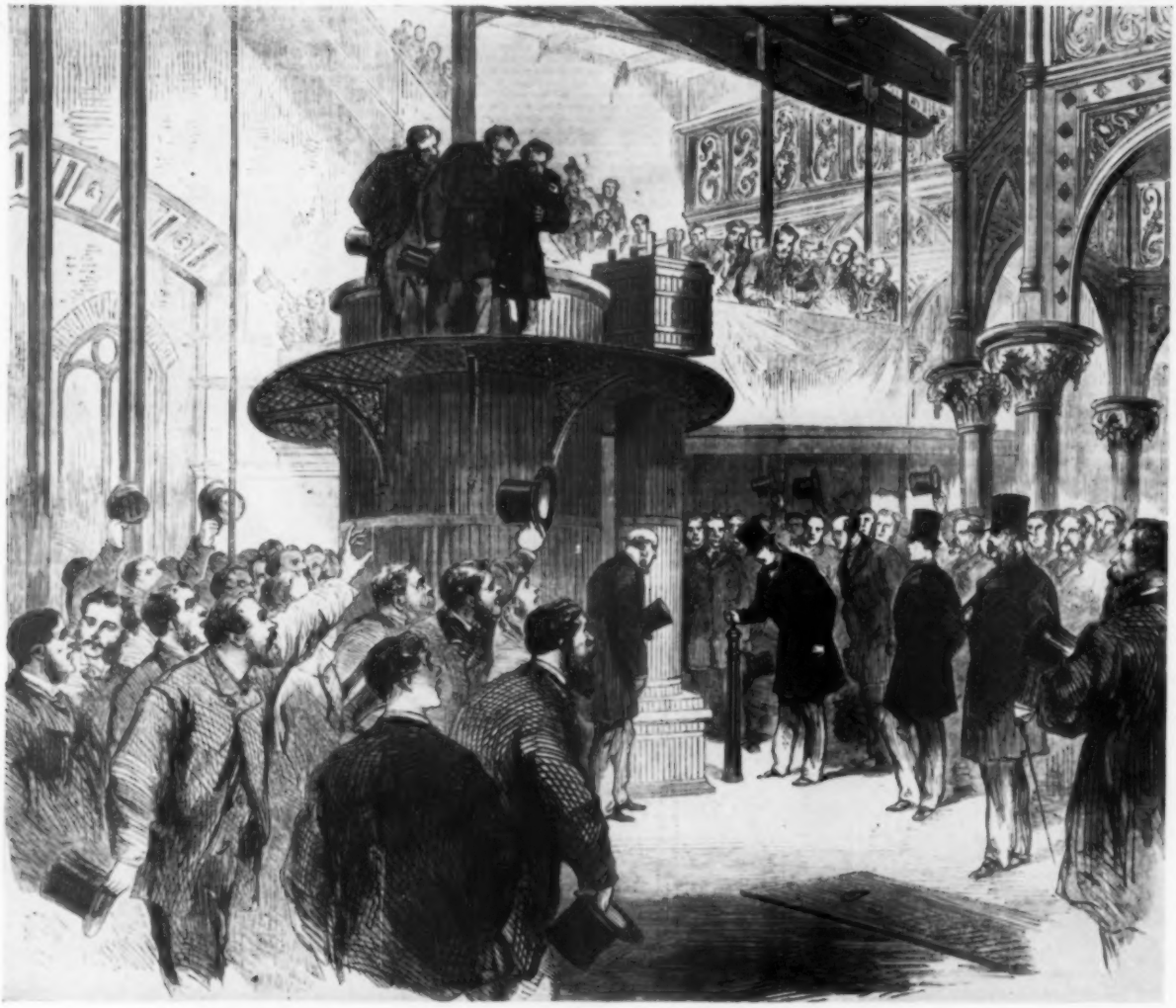


Fig. 1—THE PRINCE of Wales starting the beam engines at the Southern Outfall Works, April 4, 1865

have been many instances such as this where the opening of the works was attended by great ceremony but the departure of the "great old engines" has been almost unnoticed. In an account of the opening ceremony in 1865 the "Illustrated London News" prophesied that these engines "perhaps the finest specimens of engineering work in the country" would exist for a "very long time, indeed, longer than anyone now living may hope to see". The engines themselves admirably fulfilled the prophecy and were in service as late as 1952. Consideration is being given to preserving them intact.

Early History of London Sewerage

The earliest drainage system serving what is now the County of London comprised the natural watercourses flowing to the Thames including the ditches, which were connected to them. As London developed, brick sewers were built and were linked up to the existing watercourses and streams. As development spread to the banks of the streams they were bricked in, and by the early 1800's they were nearly all below ground. It is still possible in one sewer to pick out the brick bridge over the original stream (now incorporated into the arch of the sewer).

Beneath London's streets the old rivers can still be traced. The Tyburn, now known as the King's Scholars' Pond Sewer, rises on the western slopes of Hampstead, crosses Oxford Street (hence the name Tyburn given to the old time place of execution, near which Marble Arch now stands) and originally entered the Thames just west of Vauxhall Bridge. The Fleet river also had its source in Hampstead. Further east in the City is the Wallbrook; its source was in Moorfields and it entered the City between Mooregate and Bishopsgate, passing the sites of the Mansion House and Bucklesbury house, where the Roman Temple of Mithras was recently unearthed.

The early 19th century sewers were intended only for the drainage of surface water and the discharge into them of offensive matter was forbidden, although the prohibition was frequently ignored (see accompanying artist's sketch of the River Fleet). Between 1800 and 1850 the population of London more than doubled with a corresponding increase in the amount of water used. At the same time the introduction of water closets made the provision of an improved method of removing liquid household waste essential.

Metropolitan Commission of Sewers

A Commission was appointed to inquire into the means of improving the health of the Metropolis, which had suffered severely in the cholera

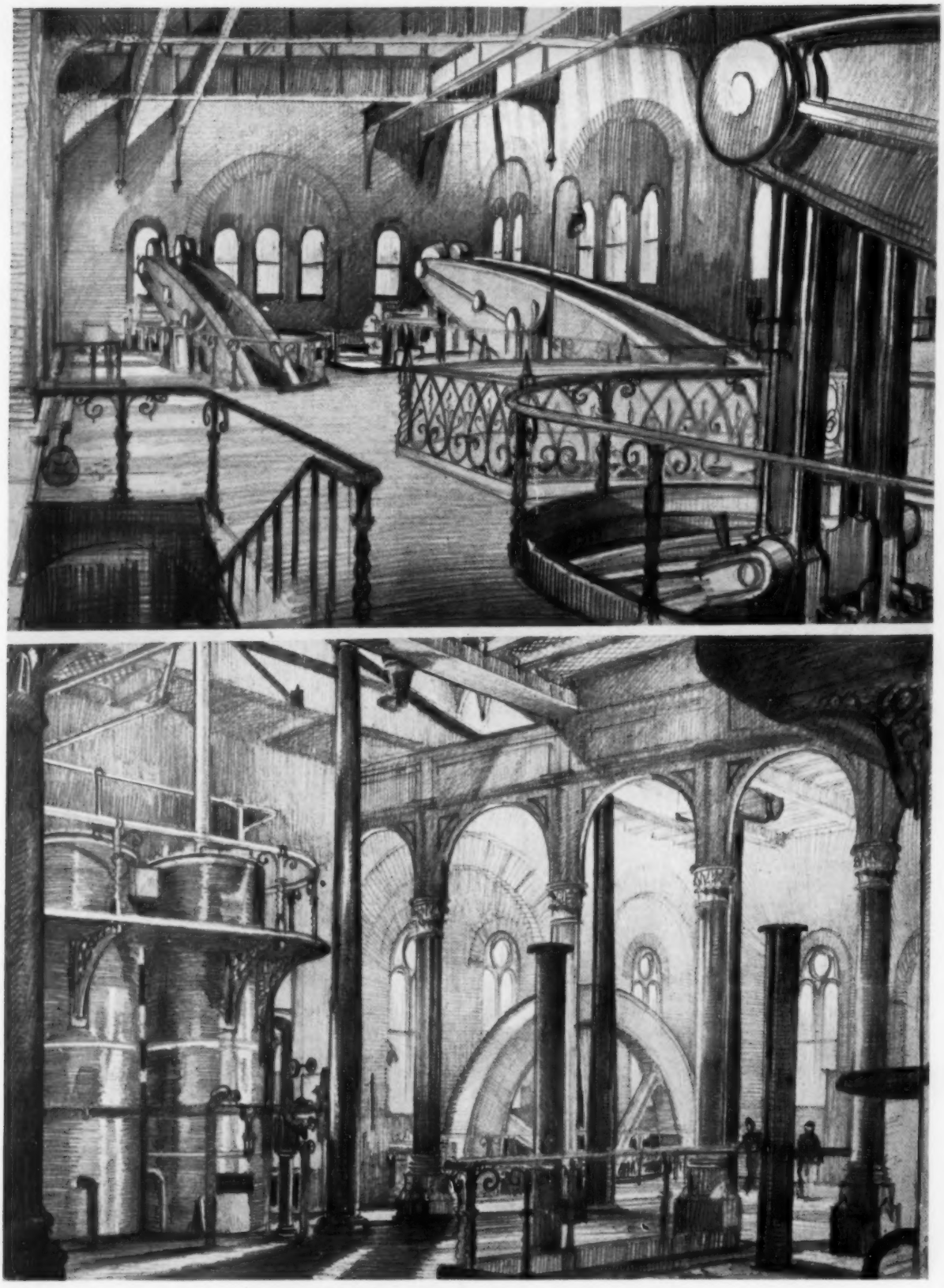


Fig. 2—ARTIST'S impression of the James Watt beam engines
Above—The platform at beam level; Below Engine house floor. Note 27 ft flywheels.

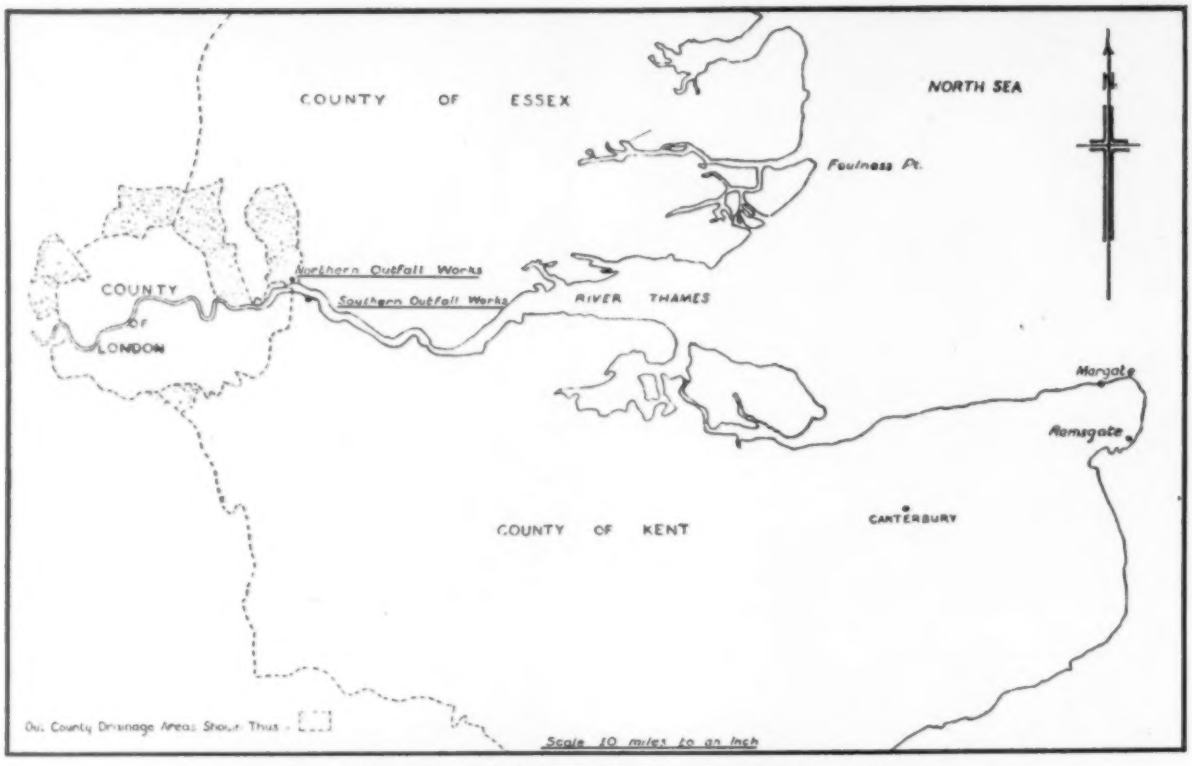


Fig. 3—MAP showing location of Northern and Southern Outfall Works.

epidemic of 1831/32, and it made its report in 1847 recommending, *inter alia*, that the administration of the laws relating to sewers in the separate districts, then under control of seven distinct Commissions, should be confined to one body of Commissioners. This recommendation was implemented by the appointment of the Metropolitan Commission of Sewers. Thus the necessity of dealing with London as a whole was recognized.

This Metropolitan Commission which set to work under the shadow of another cholera outbreak in 1848/49, had powers to compel all householders to connect their private drains to the public sewers, and in the course of a few years they had practically abolished cesspools. The formation of house drains connected to the sewers had already been made compulsory in *new* buildings under the Metropolitan Buildings Act of 1844. One consequence of this was that the sewage which was formerly allowed to collect in the cesspits was now discharged through the sewers into the Thames, with alarming results. Its broader reaches, for example, between Westminster and Waterloo Bridges, had their banks covered with vast accumulations of foul and offensive mud, which were exposed at low tide. Another cholera epidemic in 1853/54 underlined the urgency of the problem created by the discharge of sewage into the Thames, from which much of the drinking water of London was drawn.

Between 1848 and 1855 no less than six commissions were appointed. Numerous designs for improving the drainage of London were considered, but no decisions were arrived at.

Metropolitan Board of Works

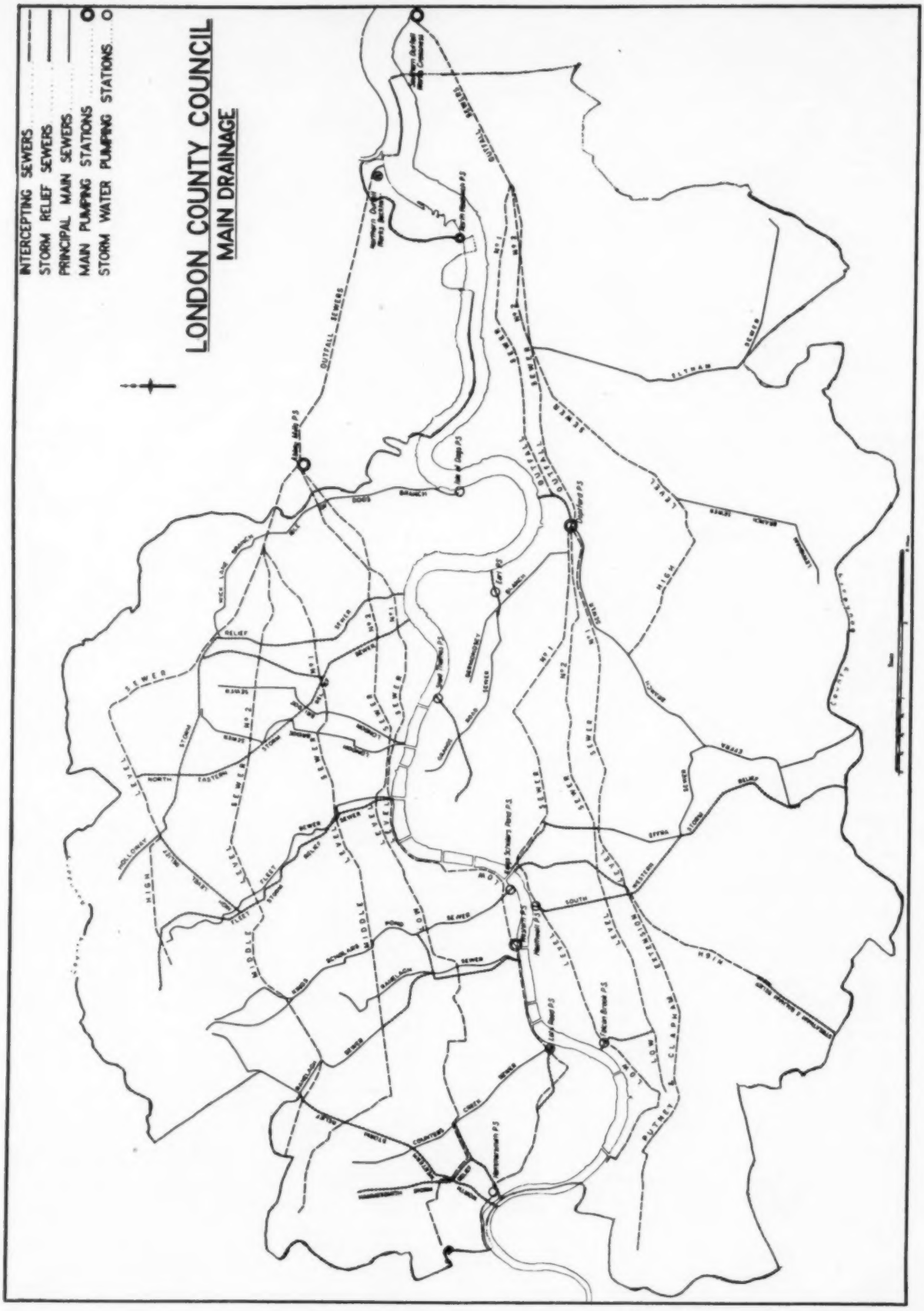
Conditions grew so intolerable that the Government decided to set up a new authority in 1855, the Metropolitan Board of Works, which was charged with the primary duty of maintaining the main sewers and constructing works to prevent sewage entering the Thames within the London area.

The Engineer of the Board, Sir Joseph Bazalgette, submitted his plans, which were adopted by the Board, for preventing sewage from flowing into the Thames in or near the Metropolis. These, however, were subject to the approval of the First Commissioner of Works and a period of inaction intervened, largely due to the belief held by a large section of public opinion that sewage could be used agriculturally and that any scheme put forward should not only diminish the pollution of the river but should also be a source of profit.

Sir Joseph Bazalgette's scheme, as eventually approved by the Board, proposed three intercepting sewers on the north side of the river and two on the south side which were to traverse London roughly west to east, intercepting the main line sewers on their courses to the Thames. The flow was to be carried to outfall sewers, which in turn would discharge it to the river below the County, on the north side at Barking, and on the south side at Crossness. The scheme was completed in 1875.

The London County Council

In 1889 the London County Council was created and took over responsibility for sewerage. From that date to the present time the Council has made many extensions to the sewerage system, constructed flood relief works and sewage pumping stations, and carried out researches into the treatment of sewage. (The locations of the two plants are shown in Fig 3, and the main drainage sewers are shown in Fig. 4). Increased flows, heavier loads on the sewage works and improved standards of practice resulted in the construction of an activated sludge plant to treat part of the flow at Northern Outfall Works between the wars; even so by 1938 the need for further extensive developments at both the Northern and Southern Outfall Works became evident. Accordingly, a series of contracts was put in hand: first at the


LONDON COUNTY COUNCIL
MAIN DRAINAGE
INTERCEPTING SEWERS
STORM RELIEF SEWERS
PRINCIPAL MAIN SEWERS
MAIN PUMPING STATIONS
STORM WATER PUMPING STATIONS
OUTFALL SEWERS
NORTH EASTERN
NORTH WESTERN
HIGH LEVEL
MIDDLE LEVEL
SOUTH WESTERN
SOUTH EASTERN
RELIEF SEWER
Abbey Mills P.S.
Lots Road P.S.
Kew Pumping Station
Hampton P.S.
Barnes P.S.
Putney Bridge P.S.
Deptford P.S.
Crossness Outfall Works
Beckton Outfall Works

Northern Outfall Works where detritus pits, screen house and primary sedimentation tanks have been recently completed, and the construction of a diffused air activated sludge plant, a power house, a sludge digestion plant and sundry ancillary works is at present in process. The estimated cost of these schemes is in the region of £8 million ($22,400,000).

Difficulties were experienced in the design of the extensions at the Northern Outfall Works, for there, work had been constructed piecemeal and each new proposal had to be fitted in to the existing works as the arrangement of the site permitted. But the Southern Outfall Works, as at present existing, vary little in form and method of use from what they were as originally constructed, and the new work here will be carried out on open land in the immediate vicinity to a carefully thought-out and master plan. The cost is estimated at £9,750,000 ($27,300,000).

Extension of Southern Outfall Works

The Southern Outfall Works serves a population of approximately 1,600,000 and has an average daily flow of 96 million Imperial gallons per day (about 115 million U. S. Gallons), with a suspended solids content of 285 parts per million and a B.O.D. of 330 parts per million.

Sewage is delivered to the Outfall Works by two low-level sewers and one high-level sewer, each of 11 feet 6 inches diameter. None of these is at a sufficiently high level for sewage to gravitate through the treatment works to the Thames at all states of the tide, and a new completely electric sewage-pumping station will be constructed.

The treatment plant will consist of detritus channels, primary sedimentation tanks, surface aeration tanks and final sedimentation tanks from which the fully treated effluent will pass to the river. In addition there will be a sludge digestion plant, a power house, a new jetty for the use of the sludge vessels, a reclamation scheme for the improvement of the river front, and various improvements of the existing works, for example, conversion of the sedimentation tanks to storm tanks. (Fig. 5).

It is intended that the works shall be as simple as practicable, the design of units orthodox, and that equipment shall consist of proprietary articles that have been well proven in practice. Metering will be reduced to a minimum.

The main treatment units, including the primary sedimentation tanks, aeration tanks, final sedimentation tanks and pumping plant mains, meters, etc., associated therewith, will form two separate treatment works capable of either individual or combined operation.

The site conditions are such that it will be necessary to found the whole of the new works on reinforced concrete piles, and about 20,000 piles will be required.

Screens

The screens will be placed on the incoming sewers so as to screen all sewage and storm-water arriving at the works. This will mean the provision of both low-level and high-level screens, but the raking gear at floor-level will be alike for both low and high-level screens. The screens will be "medium" screens with clear spaces of ¾ inch. Screenings will fall from machines to channels which will be fed with wash-water by gravity from the common inlet channel of detritus channels, and will pass to disintegrators. The disintegrators will discharge upstream of screens in order that any materials not sufficiently broken up will be caught on the screens and returned once more to disintegrators.

To minimize risk of fly-borne disease by exposure of feces, the screen house will be made fly-proof. Ventilation will be provided by fans which will blow air into the house; the air will then pass down the sewers, thus preventing foul air from entering the screen house from the sewers.

Separation of Storm-water: Sewage pumping

Storm-water will be separated by the pumping plant. Sewage pumps will be provided to deliver up to 150 mgd from the two low-level outfall sewers and 65 mgd from the high-level sewer to the detritus channels. The new pumping station will be fully automatic.

By construction of detritus channels to a water depth equal to that in the sewers the pumping head can be kept virtually constant and efficiency at maximum at all rates of flow.

The existing six "sedimentation channels" will be converted to storm tanks at very low cost. These have a total capacity of about 6 hours present D.W.F. and are therefore in line with Royal Commission recommendations. The tanks will be provided with inlet weirs set at differing levels so that the tanks commence to fill in turn. When all tanks are full the settled effluent will pass over the outlet weirs to the storm-water outfall, being measured by venturi-meter on the way.

When the total flow to works falls below 216 mgd, the storm tanks will automatically decant back via tide-flaps fixed on openings in the inlet weir walls and will be pumped to the treatment works. The tanks will be de-sludged by tractor, and ramps will be constructed to permit entry for this purpose.

Primary Treatment

Detritus channels will be provided to deal with 216 mgd but space will be reserved in order that future channels may be constructed to serve storm flows also.

The detritus channels will be of the flume-controlled constant velocity type. The principle is to arrange a rectangular standing wave flume downstream of a channel of parabolic cross-section so that a velocity of one foot per second is maintained automatically at all rates of flow without any need for mechanical or electrical control equipment and without any danger of the process being upset by injudicious operation. The effect of this is that sand is settled while feces, rags, etc., being of low specific gravity are kept in suspension by the turbulence of flow and carried away. Grit will be removed by travelling pump.

Sewage will be delivered to the primary sedimentation tanks by a system of open channels and culverts. The rate of flow to the various units will be regulated by balanced disc valves and measured by venturi meters. Flow will be evenly spread by the system of "progressive bifurcation" to a common feed channel from which the individual tanks will be fed.

The tanks, sixteen in number, will be mechanically-cleansed rectangular tanks of orthodox type. Sludge will be swept towards inlet ends by travelling scrapers and delivered into hoppers from which it will be withdrawn under hydrostatic head. Scum will be mechanically swept over a ramp into a scum channel which will serve as a sludge evacuation channel also. The scraper mechanisms will be provided with transporter carriages.

Aeration and Final Settlement

The aeration units will be of the surface aeration cone type, incorporating the latest design improvements.

There will be 32 rows of 12 pockets, or 384 hopper-bottomed pockets in all. By arrangement of inlets and baffles, a moderate degree of step aeration, or alternatively, pre-aeration of activated sludge will be made possible. Provision will be made for emptying tanks by gravity to tops of hoppers.

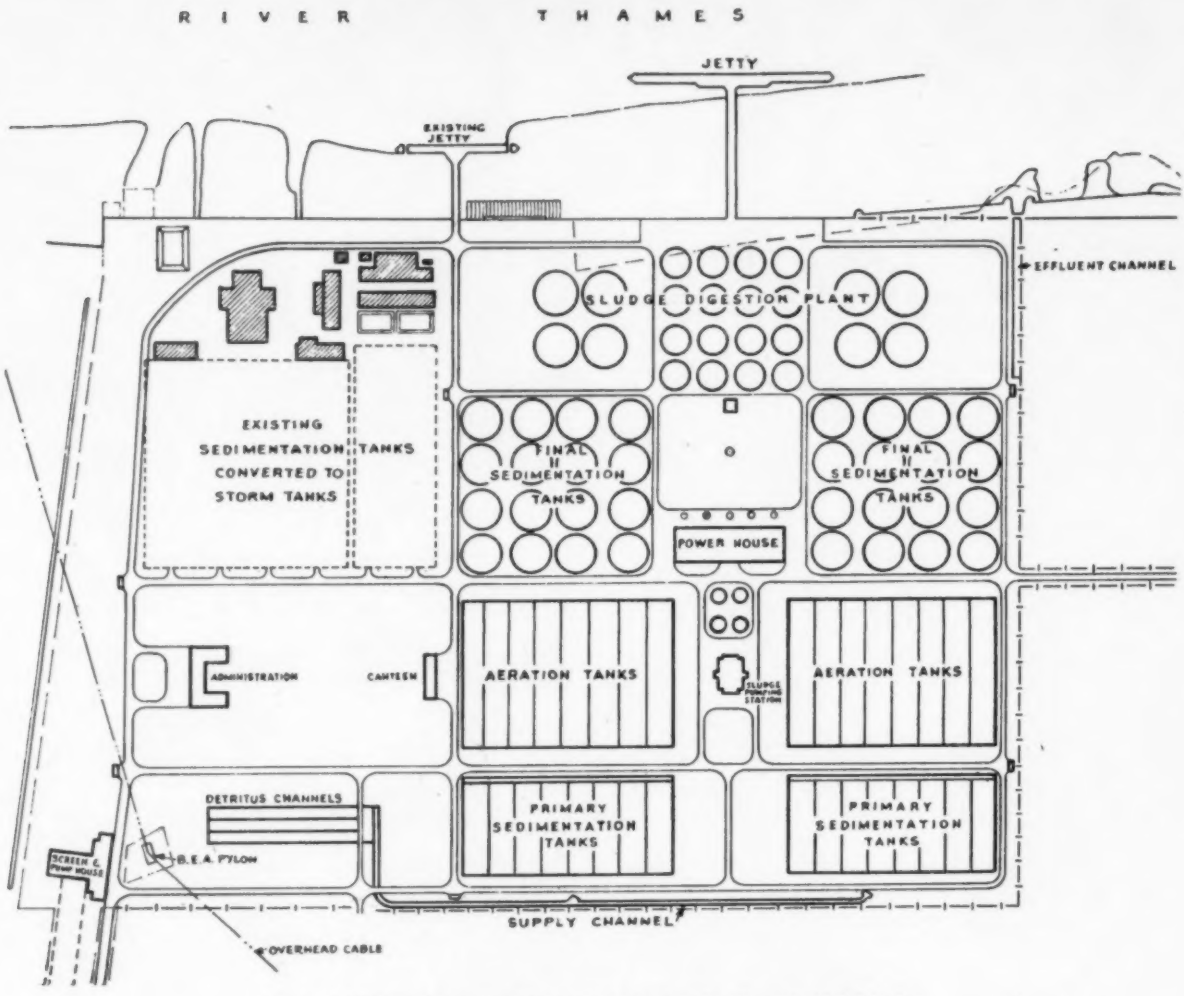


Fig. 5—LAYOUT of proposed treatment plant at Southern Outfall Works.

Re-circulated sludge will be pumped to the aeration tanks. Flow to each group of tanks will be controlled by orifice plates which will be adjusted and set by experiment.

The feed system of the 32 final sedimentation tanks has been designed to give equal distribution of flow to all tanks without the need for metering or manual control. A model has been made and tested to ascertain that distribution will be equal.

The tanks will be circular, with control inlets and double peripheral weirs suspended away from outer walls according to theoretical requirements.

Activated sludge will be gravitated to a well from which the greater part will be pumped to the aeration tanks and the remainder to the flow of sewage entering the works. Final clarified effluent will be discharged via a system of culverts and an open channel to a new main outfall to the river.

To prevent flooding of the site of works, the new works will be surrounded with flood-banks and parapet wall and the copings of walls of all sewage tanks and manholes will be raised to such levels that no spill-over will occur when an exceptionally high tide occurs simultaneously with maximum rate of flow. In addition, the ground floors of all buildings have been set above maximum recorded tide.

In deciding the levels of the final sedimentation tanks a compromise has been reached. To set the weirs above highest recorded tide would mean that sewage would always have to be pumped to a high level: if they were to be set too low they would be awash several times a year. At the level selected the final weirs will be awash for an hour or so on very rare occasions only.

Sludge Pumping Station and Control Room

The sludge pumping station will be located centrally and will deal with all raw and activated sludge pumping other than raw sludge from storm tanks which will be lifted by existing pumps in an existing pumping station.

The control room will be incorporated in the sludge pumping station. From it all parts of the works except sludge digestion tanks will be visible. It will contain the meter and recorder panels showing all flows, etc., in the treatment plant, together with a strictly limited number of remote controls of machinery.

This control room takes the place, not only of the control house, but also of the extensive operating gallery which might have been required had a diffused-air plant been installed.

Sludge Digestion

The primary digestion tanks will be generally similar to those already under construction at the Northern Outfall Works and will be equipped with heating and circulating units. Heat exchangers will be provided so

that the incoming raw sludge will recover heat from outgoing semi-digested sludge. The tanks will be covered with floating gasholder roofs. A small sludge digestion control house will be located immediately to the south of the tanks and a waste gas burner in the open space between the tanks and the power house.

Sludge will be pumped to the primary tanks from the sludge pumping station and storm-water sludge from an existing pumping station. It will gravitate from the primary tanks to the secondary tanks and from the secondary tanks to the sludge ships. The secondary digestion tanks will be simple open-topped circular tanks with conical bottoms. Ample means will be provided for the decanting of supernatant liquor. Outgoing digested sludge mains will be of ample size to facilitate flow of thick sludge. Arrangements will be provided for boosting when necessary.

Sludge Disposal Barged to Sea

The council has carried out very extensive experimental work on the dewatering of sludge by freezing and holds the patents for this process both in England and America. Up to the present time, however, while very good results have been obtained by dewatering on vacuum filters after freezing the costs of the freezing process are too high to justify the adoption of this process and for the time being sludge will continue to be shipped to sea.

The London County Council owns and operates four sludge vessels, twin screw steamers having a carrying capacity of 1,600 tons of sludge each. These vessels carry about 2¼ million tons of sludge per year and deposit it in the Black Deep about 55 miles below the purification Works.

A new jetty will be built to replace the existing, which is becoming unsound, and a new river wall will be constructed of sheet piles and copings in place of the existing irregular bank. The line of the waterfront will be straightened and a small area of foreshore reclaimed.

Power House and Auxilliary Buildings

The power house will be located centrally, north of the sludge pumping station so as to limit lengths of cables, etc. Power to the amount of 6,400 kw will be produced by consumption of 1½ million cubic feet per day of sludge gas supplemented by fuel oil. In addition, up to 1,900 kw. will be supplied by the Central Electricity Authority. A new administrative office with chemists' laboratories will be built, also sundry lavatories, staff accommodation, etc.

Power plant at the Outfall Works

Since the level of the sewers entering the Southern Outfall Works is considerably below the level necessary in the new works to enable the final effluent to flow to the river, all sewage has to be pumped up to the treatment plant, and in consequence much more power is required. The sewage gas produced in the sludge digestion plant will not be sufficient, even when used in high efficiency dual fuel engines, to produce all the power required.

In the case of the Northern Outfall Works, however, the sewage flows by gravity through the treatment plant, and in view of the relatively smaller power requirements, gas turbines can be used as prime movers in spite of their lower efficiency. The turbines are used to drive air blowers to supply air for the diffused air plant and produce electrical power for treatment plant, while heat for sludge digestion is obtained from the exhaust gases. It is not expected that sludge gas will have any detrimental effect and experience to date confirms this view. By running the turbines at a moderate gas temperature of 1200° F the maintenance work required on these units will be very small compared with engines of the reciprocating type.

There are five blower sets (one of which is a stand-by) each delivering 25,000 cu. ft of free air per minute at a pressure of 7½ lb per sq inch and three alternator sets each having an output of 620 kw. at 0.8 power factor, the gas turbines being similar in both cases and developing about 905 BHP. If required the output of the alternator sets could be raised to 750 kw. by increasing the turbine blade temperature. The gas turbines are made by Messrs. Ruston & Hornsby.

Heat exchangers are fitted which enable a brake thermal efficiency of 21.2 per cent to be obtained at full power when using gas. Provision is also made to run the turbines on oil should the gas supply fail.

The exhaust gases from the turbines pass through hot water heaters, 3,100,000 Btu per hour being obtained from each unit when running at full load, which is adequate to meet the estimated requirement of 20,000,000 Btu's per hour required for sludge heating. Two supplementary gas/oil fired hot water heaters each of 5,800,000 Btu's per hour capacity are also installed to provide additional heat if required. The overall efficiency of the plant will be not less than 50 per cent.

The gas is delivered to the turbines under pressure and for this purpose five gas compressors, made by Messrs. Reavell, are installed in a separate compartment each capable of compressing 750 c. ft. per minute to 120 lbs. per sq. inch. Any three compressors are capable of supplying the full load requirements of the gas turbines and any four machines can be arranged to cut-in automatically as the demand increases.

The Power House is adjacent to one of the largest gas works in the world and also a large generating station, consequently the air is very dirty and in order to maintain efficiency of the plant all air delivered to the gas turbines and air blowers is thoroughly cleaned by six electrostatic precipitrons, made by Messrs. Sturtevant, any five of which will meet the maximum air requirements.

The plant is arranged for automatic operation so far as practicable and all necessary safeguards are incorporated.

Trade Wastes

In common with other large industrial cities in all parts of the world the London main drainage system has to deal with the waste products of industry in increasing volume and variety. In its General Powers Act of 1953 the London County Council obtained powers for itself and the City Corporation and the Metropolitan Borough Councils (the local sewer authorities) enabling them to regulate the discharge of new or modified trade effluents into the sewers and to obtain information and prescribe conditions concerning discharges already in existence. Samples of effluents are taken regularly and where these are unsatisfactory advice is given or other suitable action taken to ensure that the effluent ceases to be offensive.

Conclusion

The London Main Drainage system, including the pumping stations and purification works serves a population of 4,526,500 at an extremely small cost to the ratepayers. The expense of operation, maintenance and repayment of debt amounts to 1.62 pence per head per week of the resident population served.

Manhattan College

Second Waste Treatment Conference Discusses

Anaerobic Digestion & Solids Handling

A Report by
JAMES M. SYMONS
Instructor in Sanitary Engng.
Mass. Institute of Technology
Cambridge, Mass.

MORE THAN 250 person attended the three day conference held at Manhattan College in New York City on April 24-26. This conference was devoted to technical papers on solids handling and anaerobic digestion. A similar conference held two years ago covered aerobic treatment of wastes.

The 1957 conference was divided into three parts: A—Anaerobic Treatment with four sessions; B—Sedimentation and Flotation with three sessions; and C—Sludge Conditioning and Vacuum Filtration with two sessions.

Anaerobic Treatment

Dr. A. M. Buswell, Research Professor University of Florida, presented a paper titled FROM SEPTIC TANK TO CONTROLLED DIGESTION in which he traced the historical development of digestion facilities from the first septic tank in 1897 to modern digestors with gas recirculation. The first septic tanks were merely to hold solids, but with the development of submerged inlets and outlets in 1881 some decomposition of the organic matter was first noted. The burning of gas from septic tank was first practiced in the 1890's but quantity of this gas was not measured until much later. Once the quantity of gas was noted it began to be trapped and used for power.

About this same time the importance of seeding digesters with well digesting sludge as an aid in starting was discovered. About 25 percent of the digester volume was the recommended seed. Modern practices of scum control by the recirculation of either supernant liquor or gas and the use of the volatile acid content of the digester as a control parameter were discussed. The paper closed with the presentation of several equations which describe the formation of methane and carbon dioxide under various conditions.

Br. Joseph McCabe

Committee
W. W. Eckenfelder

D. J. O'Connor

Principles of Digestion

Dr. H. Heukelekian, Director, Dept. of San. Engr., Rutgers University, spoke on the BASIC PRINICIPLES OF SLUDGE DIGESTION and reviewed existing literature on the subject. He opened with definitions of liquefaction and gasification as the two important steps in digestion. Inasmuch as methane forming bacteria require soluble food, the liquefaction step is a vital mechanism for proper digestion. Liquefaction was contrasted to hydrolysis, the former being the solution of solid material, while the latter is the addition of water to a compound. The gasification step of digestion is the more sensitive of the two steps, but some evidence indicates the first step to be the limiting one.

Methane producing bacteria which allow the gasification step to proceed are strict anaerobes, depending on reactions of other organisms in the digester to drive the oxidation-reduction potential (ORP) to a value low enough to permit their proper functioning. Since the presence of the nitrate or sulfate ion prevents the release of methane gas, oxygen in any form is assumed to be toxic to methane bacteria. It was also pointed out that in most cases the methane bacteria require the presence of carbon dioxide as a hydrogen acceptor.

Dr. James B. Lackey Prof. of San. Science, University of Florida, read a paper titled THE BIOCHEMICAL BASES OF ANAEROBIC DIGESTION which he had co-authored with Prof.

On Manhattan College Campus Between Sessions

A. M. Buswell H. Heukelekian —Anaerobic Digestion— J. B. Lockey C. S. Sawyer J. B. Nesbitt P. F. Morgan

E. R. Hendrickson also of the Univ. of Florida. The paper reviewed microbiology of sludge digestion and listed many of the microoganisms often found in sludge digesters. Dr. Lackey discussed the role of enzymes in the breakdown of organic matter, pointing out the specificity of enzymes. He noted that one means of catagorizing enzymes was constituitive, i.e., these present in bacteria under all conditions, and adaptive, those which are formed by the bacteria under specific conditions. This paper contained an outline of the bacterial degradation of polysaccharide, lipids, and carbohydrates, and concluded with the statement that anaerobic digestion was slower and less efficient that aerobic stabilization, but that since it required no oxygen, it may be more economical.

High Rate Digestion

Dr. Clair N. Sawyer, Prof. of Sanitary Chemistry, Massachusetts Institute of Technology, presented a paper on AN EVALUATION OF HIGH RATE SLUDGE DIGESTION. High rate sludge digestion was defined as a digestion process which involved complete mixing, either with step or continuous feeding. The paper traced the history of digestion and the early observation on the formation of scum from rising sludge which then fell through the supernatant liquor. Scum always caused a loss of digestion capacity. These observations lead to the modern practice of mixing the digesting sludge to utilize the entire contents of the tank.

Since the discharge of the digester is the same as the content the concepts of detention time must be modified. Equations were presented to compute the actual detention time of sludge in a digester being completely mixed.

Grease reduction is impaired by shorting the detention time too much, the percentage of volatile matter destroyed is also slightly reduced. Gas production on the other hand is not impaired, nor is the survial of pathogenic bacteria increased significantly. Starting high rate digesters is still under study; mechanical failure of the mixing mechanism will cause immediate scum trouble, and the material from the digester must be elutriated before further treatment. In summary the high rate digestion process is a stable efficient process requiring lower capital costs over conventional digestion.

Dr. John B. Nesbitt, Asst. Prof. of Civil Engineering, Pennsylvania State University, spoke on A BACTERIUM LOOKS AT SLUDGE DIGESTION, a paper co-authored by Prof. R. Rupert Kountz. In this paper the authors pointed out the similarities between activated sludge and digestion as two biological treatment methods. As in activated sludge, anaerobic digestion is the most efficient when the organisms are in intimate contact with the food and in the growth phase of development. They suggested a loading factor per unit weight of organisms, based on the suspended solids in the digester. Referring to Barker's work which indicated that carbon dioxide is needed by the methane forming bacteria as a hydrogen acceptor, they suggested that lime may be detrimental in some cases as it would tend to remove the essential carbon dioxide. In summary they presented a concept of activated digestion similar to activated sludge aerobic treatment, in this case carbon dioxide is used as the mixing agent and settled sludge is returned to the head end of the digestion tank as seed.

Environment Control

Philip F. Morgan, Prof. of Sanitory Engineering State University of Iowa, gave a paper entitled ENVIRONMENT CONTROL FOR ANAEROBIC DIGESTION AND GAS DIFFUSION. Co-authored was Peter J. Neuspiel of the Chicago Pump Co. The speaker reported on pilot plant studies which showed digestion with gas recirculation to be a more stable process than without any form of mixing. They also noted that after a slug feed of sludge the gas production and volatile acid rose for three hours and then fell to a level before feeding. Since mixing was so important it appears that the quanity of gas needed for recirculation was related to the diameter of the digester. The resulting equation $Q = KV^3D$, was presented and discussed. The level of volatile acids was suggested as a good measure of the operation of the process while the change in volatile solids of a complete material balance was also recommended as a good method of operational control. The three important parameters to observe to keep the diges-

W. N. Grune L. L. Langford —Anaerobic Digestion— J. V. Lunsford D. E. Bloodgood A. J. Steffen H. F. Berger

tion process under control are: (1) solids loading, (2) temperature, and (3) uniform distribution.

Jess C. Dietz, Prof. of Sanitary Engineering, University of Illinois, presented a paper on AN INVESTIGATION OF THE INFLUENCE OF SOME RADIOACTIVE ISOTOPES ON SLUDGE DIGESTION co-authored with Robert H. Harmeson. The apparatus used was described in detail. In high level experiments—200 mc.—on a batch basis, radioactive phosphorous caused a 13 per cent decrease in gas production while iodine was not as inhibitory. Radioactive sulfur caused a 50 per cent gas reduction and the mixed fission products caused a 35 per cent decrease. In low level studies —50 mc. per lb of sludge— with continuously mixed digesters, phosphorous, iodine, and sulfur caused no change in gas production, while the mixed fission products inhibited the gas production 17 per cent. As all of the radioactive chemicals except iodine were concentrated in the solid rather that the liquid phase of the digesting mixture, the radioactive chemical was held on sand drying beds and not leached to the groundwater.

W. N. Grune, Assoc. Prof. of Civil Engineering, Georgia Institute of Technology, spoke on APPLICATION OF ORP, CONDUCTIVITY, AND GAS CHROMATOGRAPHY TO SLUDGE DIGESTION, a paper co-authored with R. J. Borsh and R. H. Philip, Jr. The use of ORP, conductivity, and gas chromatrography as a measure of the effect of radioactive material on sludge digestion was described. Typical oxidation-reduction equations were presented as well as the general equation for redox potential. The apparatus used in these experiments was shown and described in detail. Curves showed ORP, gas production and pH in digesters to which radiochemicals had been added. It was noted that the presence of radioactive material increased the ORP and correspondingly decreased the gas production.

The speaker pointed out that the change in conductivity of the liquid phase of the digestion process was a measure of the breakdown of the sludge solids. Various curves were presented to show this relationship.

The gas chromatography apparatus used in this investigation was described briefly. The calibration curves for pure gases as well as mixtures were presented along with the curves of the gas from digesters handling radioactive materials.

Anaerobic Contact Process

M. B. Ettinger, Robert A. Taft Sanitary Engineering Center, Cincinnati, gave a paper entitled, CHEMICAL AND HYDRAULIC PROBLEMS OF THE ANAEROBIC CONTACT PROCESS, co-authored with J. L. Witherow and J. B. Coulter, also of SEC. The anaerobic contact process described in this paper is one in which the fresh incoming sewage is mixed with actively digesting sludge, the effluent from the primary being passed through a rock bed for polishing. The primary tank was conical in shape, in which the fresh sewage passed up through the digesting sludge. The gas from this unit was trapped. The clairfied effluent was removed over a circular weir and was then passed upward through a bed of rocks which was open to the atmosphere. This process removed 65 per cent of the organic material as measured by the chemical oxygen demand test.

The primary tank was very prone to developing thermal gradients which caused trouble when good mixing was prevented. Operational data were presented but it was somewhat affected by the discovery of an air leak in the primary tank. So far the process is odor free but the summer months are yet to come. The effect of a diurnal variation in load must be investigated as well as the effect of summer temperatures. It was concluded that a conical tank was not necessary for the primary tank.

Mesophilic and Thermophilic Digestion

L. L. Langford, Pacific Flush Tank Co. read a paper on MESOPHILIC ANAEROBIC DIGESTIONS DESIGN AND OPERATING CONSIDERATIONS, in which he reviewed the principles of good design practice for digestion facilities. He emphasised the importance of good mixing if the new principles of high rate sludge digestion were to be properly practiced. He gave two specific examples of installation whose operation was improved when adequate mixing was installed.

Jesse V. Lunsford, Asst. Prof. of Civil Engineering, State College of Washington, discussed THERMOPHILIC ANAEROBIC STABILIZATION OF PEA BLANCHER WASTES, co-authored with Prof. G. H. Dunstan. The speaker first outlined the problem of disposal of the wastes from a pea cannery which involved the seasonal overload of the municipal sewage treatment plant. An in-plant analysis of the wastes streams showed that 7 per cent of the flow contained 68 per cent of the organic load, therefore this portion of the flow was treated. The first attempt utilized two stage mesophilic digestion with no mixing, but recirculation of seed from the secondary digester to the primary. This procedure affected a 92 per cent reduction in 5 day B.O.D. load. The second attempt utilized mesophilic single stage digestion with continuous mechanical mixing. At a loading of 0.4 lbs per cu ft this process gave an 80 per cent reduction in 5 day B.O.D. but the process failed at a loading of 0.6 lb per cu ft. The final phase of study used thermophilic digestion with continuous feeding and mixing. This process required very slow acclimatization but gave an 80 per cent reduction in 5 day B.O.D. at loadings of 0.7 lb per cu ft of digester capacity. Gas obtained averaged 13 cu ft per lb of volatile matter destroyed.

—Sedimentation and Flotation—

B. Fitch A. A. Kalinske W. J. Katz J. D. Walker R. H. L. Howe J. W. Pratt

Syndets in Digestion

Don E. Bloodgood, Prof. of Sanitary Engineering at Purdue University, presented a paper co-authored with C. C. Johnson on the EFFECT OF VEGETABLE OIL AND ABS ON AN-

AEROBIC DIGESTION OF PRIMARY SLUDGE. This investigation was undertaken to discover the effect of the presence of greases and oils (which sometimes appear in sewage) on the process of anaerobic digestion. The first phase of the investigation showed that three digesters operated in parallel gave comparable results. The second phase was therefore started in which one digester was held as a control, a second digester was fed 0.5 gm of vegetable oil and a third was fed 0.5 gm of vegetable oil emulsified with a one percent ABS solution. All three digesters were actively digesting when the run started. The digesters were not continuously mixed but were shaken by hand once a day. The oil in a natural state was degraded about 70 per cent with a corresponding increase in gas production. The digester receiving the oil in an emulsified state did not continue good operation and after several days the gas production fell almost to zero. To further study the effect of ABS a third study was initiated to compare a digester with oil and one with oil and ABS. The results here were the same as described above; the ABS was not readily broken down (11 per cent) and had built up to a level of 95 mg per L by the end of the run. The control digester which was still operating well at the end of the run had 58 mg per L of ABS which came from the municipal primary sludge.

Industrial Wastes Digestion

A. J. Steffen, Sanitary Engineer, Wilson and Co., Chicago, Ill. presented a paper on TREATMENT OF PACKINGHOUSE WASTES BY ANAEROBIC DIGESTION and described the waste treated as one with high solids and high 5 day B.O.D. therefore, one which is easily amenable to anaerobic digestion. In the original pilot plant, results showed that with heating, an anaerobic process treating this waste would be a stable process which showed no lag period after shutdowns. In addition, the anaerobic process would require less land than a conventional trickling filter plant and would cost one-half to one-third-the initial cost of trickling filters. The operational cost would be higher, however.

On the basis of these results a full scale plant was designed, modified slightly to resemble an anaerobic activated sludge plant. A portion of the plant was constructed and operated, the data from the preliminary plant is to be used to help complete the design. The plant consists of a screen, an equalizing tank, heater, digester, vacuum degasifier, sludge separation, and as a polishing unit, a trickling filter, secondary clarifier and chlorine contact tank. Slides showing the construction of the plant as well as current operating data were presented.

Herbert F. Berger, Project Leader National Council of Stream Improvement, Blacksburg, Va. spoke on ANAEROBIC DIGESTION OF PULP AND PAPER WASTES. In the paper the author described experiments on the attempt to digest anaerobically both strawboard and semi-chemical pulp wastes. The digestion of semi-chemical pulp was not too stable, the gas yield and 5 day B.O.D. reduction dropping off after some time. Aeration of the effluent for six hours reduced the 5 day B.O.D. 85 to 90 per cent, however. Straw board waste gave better results. Even with no nitrogen added an 80 per cent reduction of 5 day B.O.D. was affected. Sulfite Waste Liquor, on the other hand, did not digest very well, probably due to the high sulfide concentration which was felt to be harmful to the digestion process. A satisfactory loading was found to be 0.1 lb per cu ft, if the sulfide concentration did not accumulate. In the future the author anticipates in-plant chemical recovery which will result in the discharge of weaker wastes which will no longer be amerable to anaerobic digestion.

Sedimentation & Flotation

(Ed. Note: The following four papers were reported by Prof, Don. E. Bloodgood, Purdue University, and Editor of *Industrial Wastes.*)

Sedimentation Fundamentals

Bryant Fitch, Research Director of Dorr-Oliver, Inc., in a paper on SEDIMENTATION PROCESS FUNDAMENTALS pointed out that there are four models or mechanisms in the sedimentation process. These different factors are (1) sedimentation of silt sized particles; (2) sedimentation of particles that flocculate; (3) zone settling where there is interference in settling because of the increased number of particles; and (4) compression thickening where the particles are becoming so enmeshed that the total volume of the settled solids becomes much less. He also pointed out that: (1) overflow rate in a settling tank governs for the slit-sized particles; (2) overflow rate and liquid detention in a settling tank are important when flocculent materials are being settled: (3) some settling is influenced by area of settling tank and the pounds of solids being processed in the tank; and (4) the compression of solids is influenced by the time that the solids are held in the settling tank.

D. J. O'Connor, Assoc. Prof of Civil Engineering, Manhattan College, presented an EVALUATION OF LABORATORY SETTLING DATA FOR PROCESS DESIGN in which he described a test settling cylinder that can be used in evaluating the settling characteristics of the solids in a particular waste. It is recommended that the settling cylinder be the same depth as the proposed settling tank. Samples are collected from taps located at known distances from the top of the cylinder and suspended solids determinations are performed on these samples. This data together with the known time of settling prior sampling can be plotted to produce a graph that

—Sludge Dewatering—

P. Coackley D. A Dahlstrom A. L. Genter N. Porges R. F. Weston

can be used in developing settling criteria for a waste so that an effective economical settling tank can be designed.

T. W. Lesperance, Dorr-Oliver, Inc., spoke on the APPLICATION OF FUNDAMENTALS OF WASTES TREATMENT SEDIMENTATION DESIGN and added to the discussion on sedimentation. He pointed out that flocculation prior to sedimentation can be very helpful in solids removal but he said that "use of overflow rate and liquid detention as design criteria may suffice in the selection of unit size for most sedimentation problems in the field of sewage treatment. These two factors alone are *not* enough to define completely the sedimentation requirements of many industrial waste problems. Solids handling capacity as may be determined by zone settling, unit area or compression thickening are important factors and may often control the selection of ultimate unit size."

Dr. A. A. Kalinske, Vice Pres. and Technical Director, Infilco, Inc., presented a paper on SEDIMENTATION AND FLOTATION in which he discussed gravity separation from liquids was most emphatic about his statements that temperature changes interfere with the settling of solids. He said that a two-degree change in temperature may change the removal of dissolved solids as much as 200 to 300 ppm. in some industrial wastes. He said that if activated sludge is to be separated from the liquid by flotation it is essential to use laboratory apparatus to establish the basic information needed in the design of full scale equipment. Dr. Kalinske told about a flotation system to give primary treatment to sewage in Utah. In this system conventional removals of solids are obtained in twenty minutes, thus decreasing the size of equipment needed. He did say that the cost of operation of a flotation unit was usually higher than for conventional settling tanks. Flotation units have been reported as being satisfactory for removing solids from paper mill wastes, but it is essential to run pilot plant studies full-scale installations are made.

Flotation

Robert H. L. Howe, Project Engineer, Eli Lilly and Co. gave a paper A MATHEMATICAL INTERPRETATION OF FLOTATION FOR SOLIDS-LIQUID SEPARATION in which he started from Stokes law for settling particles and developed equations to describe the flotation of small, one micron, particles. When modified and interpretated properly, the developed relationships may also be applied to the flotation of flocculant particles which occur in the activated sludge and industrial fermentation processes.

J. W. Pratt, Process Engineers, Inc., presented a talk on the APPLICATION OF PRESSURE FLOTATION PRINCIPLES TO PROCESS EQUIPMENT DESIGN co-authored with E. M. Masterson. The equipment was described in detail and consisted of a sump, pressurizing pump with air admitted, retention tank, back pressure regulator, and flotation unit. The overflow rate on the flotation unit was 1 to 4 gal/day/ft sq with a depth of 4 to 6 feet. The sludge is collected at the surface and as the bouyed sludge may lose its air and sink, it is important to remove the sludge quickly. This limits the size of the tank, as the skimmer cannot be too large. The speaker also recommended a bottom scraper to prevent the accumulation of gross solids. The floating material is often so thick that it must be removed with a screw conveyer. A flotation test kit was described as a qualitative measure of the applicability of flotation to a specific waste.

J. Gruspier, student at Manhattan College, presented a paper entitled STUDIES ON DISSOLVED AIR FLOTATION OF BIOLOGICAL SLUDGES co-authored with W. W. Eckenfelder, T. F. Rooney, and T. Berger. The speaker described a laboratory study made to determine the feasibility of using air flotation as a means of clarifying activated sludge mixed liquor. In this study pressurized effluent was used to introduce the air into the flotation unit. Slides were used to show the relation of effluent quality as measured by suspended solids to the retention time, pressure, velocity of recycle entrance to the flotation tank, percentage of recycle and mixed liquor concentration. Optimum values for each of these variables was obtained. At the optimum values a 3 per cent solids sludge was skimmed from the floation unit. The ratio of air to solids was related to performance and this ratio was suggested as a method of design of the system. In addition to the slides, a movie was shown demonstrating the operation of the unit.

L. L. Hedgepeth

R. E. Fuhrman

—Presiders—
J. F. Laboon L. F. Warrick

R. Hazen

J. E. Kinney

Sludge Conditioning and Filtration

A. L. Genter, Cons. Engr. Baltimore, read a paper on SLUDGE ELUTRIATION AND WHAT IT ACCOMPLISHES. The various types of coagulants and the problems with different classes of sludges (primary, digested, secondary, etc.) were reviewed. The concept of liquid and solid coagulant demand was discussed in relation to elutriati on reducing the liquid demand primarly. Batch, continuous feed, and two stage elutriation tanks were described.

R. F. Weston, Cons. Engr. of Weston and Eckenfelder & Associations, had co-authored a paper with R. G. Merman, entitled TREATMENT AND DISPOSAL OF REFINERY WASTE SLUDGES. In this talk the speaker described the problem of the Atlantic Refining Co. The primary method of treatment was chemical precipitation followed by a picket fence type of sludge thickner. At this stage of the process the sludge has a moisture content of 97 per cent. Vacuum filtration was the selected method of dewatering with precoat vacuum filters used. The filter cake is then incinerated with the heat being used to generate steam. The cost is about $15 per ton and 18 tons of day solids are processed each day.

Sludge Dewatering

D. A. Dahlstrom and C. F. Cornell of The Eimco Corp., Palatine Ill., spoke on the ECONOMIC ADVANTAGE BY IMPROVED SLUDGE CONDITIONING AND VACUUM FILTRATION.

Troublesome conditions that tend to discourage filtration are rapid media blinding, low cake rate, high cake moistures, and high chemical consumption. These conditions are usually encountered in the filtration of sludges with low solids content. One of the major reasons for the occurrence of these conditions is improper sludge conditioning.

The fundamental requirement in designing sludge conditioning equipment is a rapid and intimate interpenetration of flocculating reagents with the sludge particles in a fluid regime. In a study of the fluid mechanics involved various types of agitator impellers and various baffling arrangements were investigated in order to determine the optimum design for good sludge floccule formation.

Maximum filter rates can be obtained by maximizing feed solids concentration, pressure drop or vacuum, and the fraction of cycle time employed for cake formation; and by minimizing filter cycle time, specific cake resistance (through proper sludge conditioning) and filter media resistance. Cake moisture content may be minimized by maximizing vacuum, cake dewatering time, proper conditioning and filtration temperature; and by minimizing cake thickness.

(Ed. Note: The following two papers were reported by E. Trubnick, Technical Director, Komline-Sanderson Co., Peapack, N. J.)

Dr. P. Coakley, Rockerfeller Research Assistant in Public Health Engineering, University of Durham, Kings College, Newcastle on Tyne, Great Britain, presented his report on LABORATORY SCALE FILTRATION EXPERIMENTS AS AN AID TO THE SLUDGE DEWATERING PROBLEMS.

Using Carman's basic filtration equation Dr. Coackley derived an equation to express filtration results by means of the constant, specific resistance. The specific resistance of a sludge can be determined experimentally in the laboratory by what may be considered a modification of the Buechner Funnel test, measuring the time required for collecting measured amounts of filtrate under constant pressure etc. Theoretically the specific resistance of a sludge should be independent of the solids content, but in practice if found that, in general, the higher the solids concentration the higher is the specific resistance.

Chemical conditioning with ferric chloride or with aluminum chlorohydrate decreases specific resistance until an optimum dosage is reached; dosages beyond this result in an increase in specific resistance. The minimum specific resistance is reached with a lower dosage of ferric chloride than of aluminum chloro-hydrate. The latter compound is used in England since it is available at lower cost.

Anaerobic digestion results in a decrease in specific resistance, which is observed in the early stages of the digestion; the resistance of supernatant solids is approximately 15 times that of the original sludge solids. Elutriation effects a 10 per cent reduction in specific value. Aerobic digestion at 20° C without seeding causes an increase in specific resistance, while a decrease in specific resistance is noted if the digestion mixture is seeded.

Specific resistance varies with pressure (or vacuum), and can be used to calculate the coefficient of compressibility, which is an index of the effect of vacuum on a given sludge. An incompressible sludge would have a coefficient value of 0 while a high compressible sludge would have a value of 1.0.

The author has determined that the compressibility coefficient for unconditioned digested sludges varies from 0.7 to 0.86; for waste activated sludge from 0.6 to 0.8. It is believed that compressibility of coagulated sludges is much greater. Therefore it would seem that it does not pay to filter at the highest possible vacuum.

Messrs Trubnick and P. K. Mueller of Kombine-Sanderson Engineering Corp., reported on VACUUM FILTRATION PRINCIPLES AND THEIR APPLICATION TO SEWAGE SLUDGE DEWATERING.

In the dewatering of sewage sludge filter production rates depend on three general factors, (1) the characteristics of the sludge, such as the size, shape and charge of the solid particles, viscosity, solids concentration, chemical composition and compressibility; (2) treatment of the sludge, including the amount and type of chemicals used in conditioning, as well as the techniques used in conditioning the sluge; and (3) the design of the filtration equipment, with special emphasis on the type of filter media used.

Determination of compressibility coefficients of several conditioned sludges, by the methods suggested by Coackley, show values ranging from 0.79 to 1.19. Filter leaf tests indicated that increase in vacuum did not produce significant increases in yield. From this evidence, and from previously reported work, the authors concluded that vacuums greater than 12 or 15" Hg are superfluous in filtering conditioned sewage sludges.

Pilot plant tests and analysis of operating data from several plants indicate that overdosages of conditioning chemicals, both lime and ferric chloride, depress filter yields. Observations have been made on the techniques of sludge conditioning and operational recommendations are listed.

The dewatering of fresh sludge is made possible by the use on nonclogging filter media. Fresh sludge filtration offers economic and operational advantages. Chemically conditioned, dewatered fresh sludge can be disposed of by means of incineration or fill, without odor or other nuisance. Preliminary investigations indicate low coliform count and little or no pathogenicity in sludge disposed of in this manner. The return to the primary clarifiers of filtrate containing comparatively high suspended solids does not affect the efficiency of the clarifiers in any respect.

Miscellaneous

Nandor Porges, Chemist, Eastern Regional Research Laboratory, U. S. Dept of Agr. spoke on the AEROBIC STABILIZATION OF SEWAGE AND WASTE SLUDGES. During his talk the speaker reviewed much of the literature which he and his co-workers have published in the past few years. He pointed out that removal of organic matter was the sum of oxidation and synthesis and that in the synthesis process some glycogen like material is stored in the cell. About 50 per cent of a cell's own weight can be stored. In addition, he discussed the change in predominance which occurs in a batch type of activated sludge plant. He also noted that in a batch activated sludge system a long aeration time will prevent the build up of solids in the system. To conclude he spoke of endogenous respiration and discussed the destruction of sludge by this process in detail.

(Ed. Note: Unfortunately, because of concurrent sessions it was not possible to obtain coverage and reports on four papers. These are: "Hydraulic Characteristics of Gravity Separators" by G. A. Rohlich, Univ. of Wisconsin; "A Comparative Study of The Hydraulic Characteristics of Two Types of Circular Solids Separation Basins" by W. T. Katz and A. Geinopolos of Chain Belt Co., Milwaukee; "The Uniflow Tank——An Improved Settling Tank" by T. L. Dallas, Mass. State Dept. of Health; and "Inlet Diffusion Control in Vertical Flow Basins" by J. D. Walker and D. E. Drier, Walker Process Equip. Co., Aurora, Ill.——Our apologies to these authors for the omission.)

REPORT FROM ABROAD

Determination of Flow Characteristics in Sewage Works Plants

A digest of an important contribution by the London County Council

by JOHN FINCH

Mr. Finch is Manager of the Sewage Disposal Department, Slough, England. In his reports from abroad he discusses topics and opinions of timely interest. He welcomes the opportunity of replying personally to readers desiring additional information regarding subjects covered in his series.

A VERY IMPORTANT contribution to the technical literature relating to hydraulics and settling tank performance of sewage treatment plants was recently presented by three workers from the London County Council—Dr. S. G. Burgess, and Messrs. A. F. Green and L. B. Wood.

The paper was entitled "The Determination of Flow Characteristics in the Sewage Works Plant". When presented to the Metropolitan Branch of the Institute of Sewage Purification in London, it drew a very appreciative audience who made full use of the time made available for discussion of the wealth of important points which presented themselves in the context of the paper.

The greatest interest devolved on the investigation of the operation of one of the large rectangular settling tanks recently installed at the L.C.C. Outfall Works (the aspect of the paper covered by this article) and the greater part of the discussion was concerned with the results of this investigation.

During recent years, projects for the new purification plant at the Outfall Works of the London County Council have been undertaken, and it became desirable to make tentative preliminary estimates of the results to be expected from certain components incorporated in the design. After some of the new plant units had been put into service, information was required to check their performance under varying conditions, in order to establish the best practicable methods of operating them.

Most of the problems were in some way connected with rates of flow, and could be examined satisfactorily only in the full scale units themselves, as the conditions under investigation could not be reproduced in laboratory or small experimental units. Modern flowmeters, which under suitable condition of operation, are accurate to within about 3 percent, show only the volume of flow at a given point, and consideration was therefore given to methods designed to supplement the information given by the meters. Conventional methods such as the addition of fluorescein, or salt, or, in one experiment, dyed paper pulp, followed by appropriate chemical or physical examination, were tried; they all failed, either by high dilution of the indicators, by adsorption on solid matter, or by biological decomposition.

Timing Flows With Isotopes

Amongst these methods, the use of radioactive isotopes as tracers was a promising choice.

A series of preliminary experiments was also carried out on one of the new primary sedimentation tanks, recently brought into full service. The tanks are rectangular in shape, and are 250 feet long, 75 feet wide, and 11 feet deep. They are end-fed over a weir at the inlet end, and the effluent discharges into a suspended discharge channel at the far end of the tank. This in turn delivers by three outlets from each tank into an effluent channel 4 feet 3 inches wide; the depth of effluent in this channel varies with the rate of flow of sewage through the plant. During the whole of the experiments, the tank was scraped every 2 hours by a Mieder-type scraper.

For the experiment, it was proposed to use Bromine-82 as tracer, as in the presence of a large excess of inactive carrier, it was anticipated that most of it would appear in the effluent, and very little be adsorbed on the sludge. Preliminary work done in the laboratory confirmed that some 90 percent or more of the activity could be expected to appear in the effluent. As the effluent channel is 4 feet 3 inches wide, a counter tube suspended in the middle of it would be counting in the maximum possible volume. A rough calculation showed that if counts of the order of hundreds per second were to be obtained, and assuming that virtually all the activity passed the counter tube in the space of about one hour, a dose of activity of the order of 1.5 curies per tank would be required. The design of the plant is such that each pair of tanks is supplied by a common inlet, and the pair is interconnected. This meant that either the isotope had to be introduced directly into the tank under test, at the inlet end, or, if the isotope were to be introduced into the supply channel, a higher level of activity would have to be used, to compensate for its being divided between the two tanks.

Procedure

The procedure adopted was as follows:—10 grams of Bromine-82 (as ammonium bromide), of activity about 150 mC/gram, were dissolved in 100 mls. of water in a beaker, and the contents of the beaker then transferred to a bucket containing 2 gallons of water in which had been dissolved 200 grams of ammonium bromide as inactive carrier. The whole contents of the bucket were then tipped, quickly but carefully, into the supply channel to the tank and, a few seconds later, the recorder was started up.

As already indicated, the counter

tube was immersed in the effluent channel, exactly in the centre, and connected to the ratemeter and recorder. Each sedimentation tank contains 1.29 million gallons, and it was decided to plot the flow of labelled material through the tank at four different rates of flow: 8, 12, 16 and 20 m.g.d. Arrangements were therefore made for the flow to the tank to be maintained at these four rates on each of four consecutive days, and the works staff took great care to ensure that the flow was accurately maintained at the correct rate throughout the experiment.

The results obtained indicated quite conclusively that the observed retention time in the tank is always shorter than the calculated time, and that the amount by which the observed retention time deviates from the calculated time increases with decreasing flow rate. No attempt has been made to account for this deviation, though the authors state that the temptation to speculate on it has been very great. Later in the year, it is planned to carry out a careful survey of the contents of the tank, both horizontally and vertically, in order to discover the pattern of movement within the tank at various rates of flow, and to ascertain the effect of temperature differences between the incoming sewage and the liquid in the tank, and how the maximum suspended solids removal could be effected when the pattern of flow in the particular circumstances has been ascertained.

During the experiments at maintained regular flows, suspended solids and B.O.D. were determined on representative samples taken every 15 minutes throughout the period of each test. The results obtained for suspended solids were unusual, but as there was no possibility of error in sampling or determination, they are given in the accompanying table.

The L.C.C. workers say it must be added that average daily samples, when the flow through each tank varies within wide limits, do not give such figures on a year's average.

The use of an oil-soluble dyestuff, to be adsorbed on solid particles, was found to be very successful. Activated sludge in mixed liquor, in two types of settling tank, was labelled in this way, and it was demonstrated that there was little difference in the performance of the two designs tested. This method, the authors state, has the advantage of requiring very simple apparatus and no special skill, and, although readily applicable to the conditions in large scale work, it can be used with equal success on the smallest scale.

Experiments with radio-active tracers on an activated sludge re-aeration tank, in which air was constantly blown into the sludge, showed that the retention time was close to the theoretical time, and that there was good mixing and no short-circuiting. In sedimentation tanks, the effective retention time was much less than the theoretical time, and the divergence between observed and theoretical time increased rapidly with decreasing flow. No attempt has been made at this stage to explain this discrepancy, and it is planned that more work will be done in the near future to throw further light on this aspect.

Discussion

The discussion which followed the presentation of the L.C.C. paper was lengthy, as indeed befitted a contribution of such moment. The study of settling tank characteristics is possibly one of the most important problems in the hydraulic field as applied to the sewage treatment plant, for there is still very considerable room for improvement in the performance of even the most modern types of tank, due to the inefficiencies associated with unsuitable inlet and outlet arrangements, projections and obstructions in the tank itself—or on the rotating bridge in the case of circular tanks—which cause streamlining or short-circuiting of volumes of liquid with unfortunate effects on the effluent from the tank.

In the case of the circular settling tank very long weirs over 300 feet long cannot be installed or maintained truly level except perhaps at great expense. Again in the case of the circular settling tank, perforated diffusion drums, which can and do choke, can create very poor detention factors, and diffusion drums which can choke and are not easily cleaned, constitute the very worst in design.

Bad inlet arrangements are notoriously producers of poor detention factors, and although many inlet arrangements have been devised for all shapes of tanks, the ideal inlet has yet to be designed.

The problem of settlement tank design has aroused a great deal of attention over the years, but very much remains to be done.

Messrs. Burgess, Green and Wood, make the comment that in the case of the large rectangular sedimentation tank temptation to speculate on the factor, that the amount by which the observed retention time deviates from the calculated theoretical time increases with decreasing flow rate, has been very great, and it is hoped that in due course they will be persuaded to indulge in a little speculation on the matter, for it is an important one, particularly when one realizes that the implication would apparently be that at low flows the sedimentation tanks are less efficient than at high flows, from the point of view of effective capacity, for at a theoretical or nominal retention time of 3.86 hours the observed retention time is approximately 1.2 hours, or about 33 percent of the theoretical, whereas at a theoretical or nominal retention time of 1.55 hours, the observed retention time is about 0.8 hours, or approximately 50 percent of the theoretical. In other words, it is indicated that the larger tank has really little to offer over the smaller tank, and this is borne out in the data given in the text of the paper by the authors, for at retention times (theoretical of 3.86; 2.58; 1.93 and 1.55 hours respectively) the percentage removals of suspended solids were 89, 87, 84 and 82. To take the two extremes in retention time a tank with a theoretical retention time of 3.58 hours only gave no more than 8-9 percent greater removal of suspended solids than did the tank with a theoretical retention time of 1.55 hours! On the basis of the B.O.D. removal figures given by the authors, there was little difference in the two extreme retention times the removal in each case being about 50 percent.

During the course of the discussion it was learned that so far as B.O.D. is concerned, actual practice in the operation of the large sedimentation tanks under normally varying flow conditions showed that the average B.O.D. reduction was about 33 percent. In other words actual normal performance at varying flows was only 2/3rds as good as operation at a fixed rate of flow—a very interesting point—with no difference in B.O.D. reduction under fixed flow conditions at 3.86 or 1.55 hours retention.

Analysis in p.p.m.

Rate of Flow m. g. d.	Suspended Solids		B. O. D.	
	Sewage	Effluent	Sewage	Effluent
8	317	35	338	177
12	460	61	384	159
16	627	100	515	210
20	101	557	485	244

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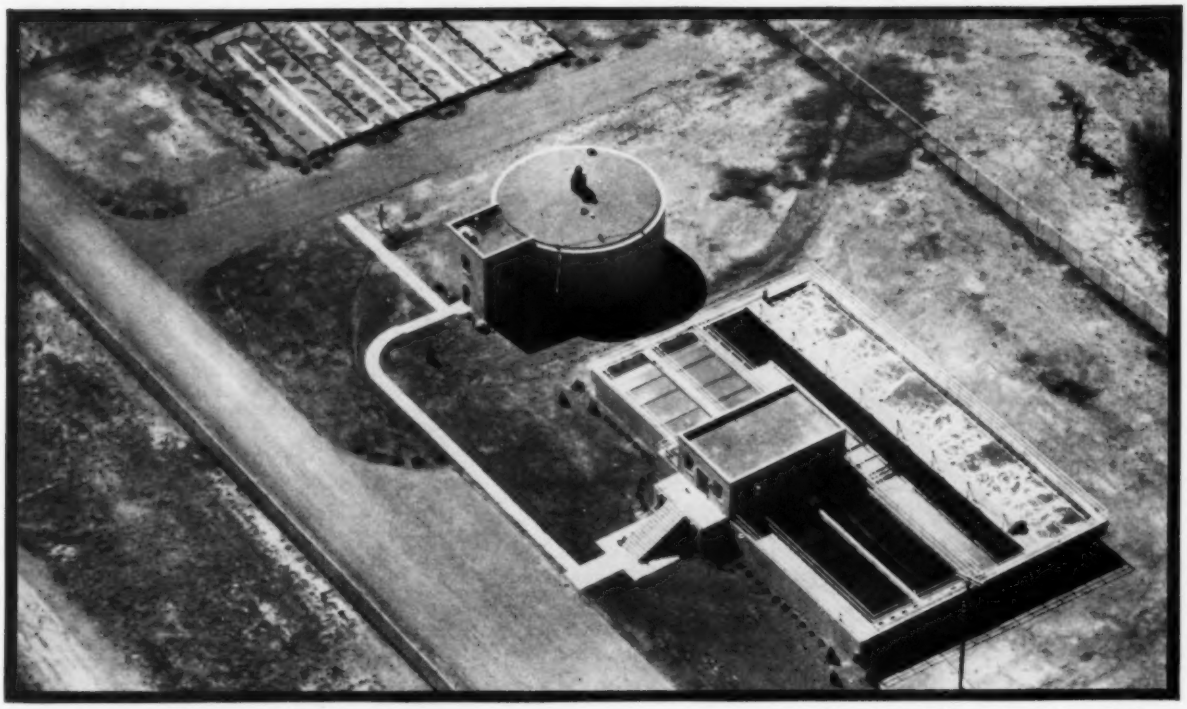

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PROFITABLE Sewage Sludge Disposal

Every sewage disposal plant has a by-product—sewage sludge—that must be disposed of. Some plants burn their dried sludge in expensive incinerators—wasting a valuable, readily saleable product and missing a chance to write-off a large portion of their operating costs.

Many municipalities dump the dried sludge cake into the hopper of their Royer Shredder and turn this by-product into a tidy profit. "Royerated" sludge is desired as a fertilizer by florists, nurserymen, golf courses, professional gardeners and the home owner alike. It is a highly desirable plant food, high in Nitrogen and Phosphoric Acid, both essential plant food elements. Unlike many other fertilizers, "Royerated" sewage sludge cake is sterile, cannot carry weeds, will not "burn" even the most tender new grass seedlings.

As a result of increased interest in sewage sludge as a source of municipal income, the Royer Foundry & Machine Company has re-edited and re-issued their popular "Sewage Sludge Utilization Datalog," describing this process in detail. We invite you to write for a free copy. It pictures and describes the Royer Shredders that have made sewage sludge an asset to communities all over America.

Please send me a copy of your new edition of the information-packed "Sewage Sludge Utilization Datalog."

Name_____ Title_____

Plant_____

City_____ Zone_____ State_____

We dispose of our dried sewage cake by_____

_____

☐ I am interested in a demonstration of the Royer Shredder at work.

ROYER FOUNDRY & MACHINE CO.

ROYER

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W&SW

Meetings Scheduled

1957

July 8-12—University Park, Pa. (*Pennsylvania State Univ.*)
SEVENTH ANNUAL PENNSYLVANIA WATER WORKS SCHOOL, Clifford V. Smith, Jr., Dept. of Civil Engrg. The Pennsylvania State University, University Park, Pa.

Aug. 8—Greenville, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Aug. 12-16—Blacksburg, Va. (*Va. Polytechnic Institute*)
VIRGINIA SHORT SCHOOL FOR OPERATORS WATER & SEWAGE TREATMENT PLANTS, W. A. Parsons, Assoc. Prof. San. Engr., Va. Polytechnic Institute, Blacksburg, Va.

Aug. 26-28—University Park, Pa. (*Pennsylvania State Univ.*)
PENNSYLVANIA WATER WORKS OPERATORS' ASSN., Secy., Harry A. DeWire, 29 Chestnut Street, Lewistown, Pa.

Aug. 28-30—University Park, Pa. (*Pennsylvania State Univ.*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, c/o Pennsylvania Dept. of Health, 916 Diamond, Meadville, Pa.

Sept. 4-6—Milwaukee, Wis. (*Hotel Schroeder*)
WISCONSIN SECTION, A.W.W.A., Secy., Harry Breimeister, Chief Utility Engr., City Engineer's Office, City Hall, Milwaukee 2, Wis.

Sept. 11-13—Upper Saranac Lake, (*Saranac Inn*)
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, Rensselaer Valve Co., c/o Ludlow Valve Co., 11 W. 42nd St., New York, N. Y.

Sept. 11-13—Sioux Falls, S. D. (*Sheraton-Cataract Hotel*)
23RD ANNUAL SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Secy., Charles E. Carl, S. D. Water & Sewage Works Conference, Pierre, S. D.

Sept. 15-18—Boston, Mass. (*Hotel Statler*)
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, N.E.W.W.A., 73 Tremont St., Boston 8, Mass.

Sept. 15-18—Baltimore, Md. (*Lord Baltimore Hotel*)
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Secy., F. J. Van Antwerpen, 25 West 45th Street, New York 36, N. Y.

Sept. 18-20—Cincinnati, Ohio (*Netherland Plaza Hotel*)
OHIO SECTION, A.W.W.A. Secy., M. E. Druley, Dist. Mgr., Dayton Power & Light Co., Wilmington, Ohio

Sept. 23-25—Louisville, Ky. (*Brown Hotel*)
KENTUCKY-TENNESSEE SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell, Cons. Engrs., 553 S. Limestone Street, Lexington, Ky.

(*Jointly With*)

KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Secy., S. Leary Jones, Cordell Hull Bldg., Nashville, Tenn.

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main connections!

Any movement of a branch main creates high stresses in the main at the branch main connection. Mueller Tapping Sleeves and Valves are designed to actually strengthen the main at this point. Connections may be made quickly—under pressure—without loss of water or interruption of flow.

A special, heavy-flange connection between the tapping sleeve and tapping valve assures positive alignment for accurate drilling and ease of installation.

Mueller Tapping Sleeves are available in either the Mechanical Joint or Calked Type.

A Mechanical Joint Sleeve for a specific nominal size can be adapted to fit all sizes of cast iron pipe regularly used by changing end gaskets.

The Calked Type Sleeve features a raised cast ring which centers the sleeve and reduces the quantity of lead required.

Mueller Tapping Valves have oversize seat openings to allow the use of full-size shell cutters. They can be furnished with "O" ring or conventional packing and mechanical joint or calked outlets. All-bronze disc assemblies are also available.

Consult your Mueller Water Works Catalog W-96 or see your Mueller Representative for full details.

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Sept. 24-25—Santa Fe, N. M. (*La Fonda Hotel*)
ROCKY MOUNTAIN SECTION, A.W.W.A., Secy., Jack W. Davis, Dist. Mgr., Transite Pipe, Johns Manville Sales Corp., 301 Continental Oil Bldg., Denver 2, Colo.

Sept. 25-26—Stillwater, Okla. (*Oklahoma A & M College*)
OKLAHOMA INDUSTRIAL WASTES CONFERENCE, Prof. Quintin B. Graves, Oklahoma A & M College, Stillwater, Okla.

Sept. 25-27—Detroit, Mich. (*Leland Hotel*)
MICHIGAN SECTION, A.W.W.A., Secy., T. L. Vander Velde, Chief, Sec. of Water Supply, State Dept. of Health, Lansing 4, Mich.

Sept. 25-27—Fargo, N. D. (*Gardner Hotel*)
NORTH CENTRAL SECTION, A.W.W.A., Secy., Leonard N. Thompson, General Manager, Water Dept., St. Paul 2, Minn.

(*Jointly With*)

NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Secy., Jerome H. Svore, c/o State Dept. of Health, Bismarck, N. D.

Sept. 29-Oct. 1—St. Louis, Mo. (*Hotel Sheraton Jefferson*)
MISSOURI SECTION, A.W.W.A. AND MISSOURI WATER & SEWAGE CONFERENCE, Joint Meeting, Secy., Warren Kramer c/o State Office Bldg., 6th Floor, Jefferson City, Mo.

Oct. 7-10—Boston, Mass. (*Hotel Statler*)
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSNS., Ralph E. Fuhrman, Exec. Secy., 4435 Wisconsin Ave., N. W., Washington 16, D. C.

Oct. 10—South Paris, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Oct. 13—16—Oklahoma City, Okla. (*Municipal Auditorium*)
SOUTHWEST SECTION, A.W.W.A., Secy., Leslie A. Jackson, Municipal Water Works, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 14-18—New York, N. Y. (*Hotel Statler*)
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wiseley, 33 W. 39th Street, New York 18, N. Y.

Oct. 16-18—Des Moines, Iowa (*Fort Des Moines Hotel*)
IOWA SECTION, A.W.W.A., Secy. J. J. Hail, Supt., Water Dept., City Hall, Dubuque, Iowa

Oct. 17-18—Halifax, Nova Scotia (*Nova Scotian Hotel*)
CANADIAN SECTION, A.W.W.A., 10th Annual Meeting—Maritime Branch, Secy. J. D. Kline, Pub. Service Comm., P. O. Box 608, Halifax, N. S.

Oct. 20-23—Biloxi, Miss. (*Buena Vista Hotel*)
ALABAMA-MISSISSIPPI SECTION, A.W.W.A., Secy., C. M. Mathews, Asst. Supt., Public Service Comm., 19 West Commercial Street, Yazoo City, Miss.

Oct. 23-24—Wheeling, W. Va. (*McLure Hotel*)
WEST VIRGINIA SECTION, A.W.W.A., Secy., Hugh W. Hetzer, Engr., West Va. Water Service Co., P. O. Box 1906, Charleston 27, W. Va.

(*Jointly With*)

WEST VIRGINIA SEWAGE & INDUSTRIAL ASSN., Secy., G. O. Fortney, c/o State Dept. of Health, Charleston 5, W. Va.

Oct. 24-26—Atlantic City, N. J. (*Hotel Madison*)
NEW JERSEY SECTION, A.W.W.A., Secy., Albert F. Pleibel, 683 Prospect Street, Maplewood, N. J.

Oct. 24-26—Seattle, Wash. (*Franklin Hotel*)
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Gilbert H. Dunstan, State College of Washington, P. O. Box 176, Pullman, Wash.

Oct. 28-30—Toronto, Ontario (*King Edward Hotel*)
CANADIAN INSTITUTE ON SEWAGE & SANITATION, Secy., Dr. A. E. Berry, Administrative Office, 72 Grenville St., Toronto, Ontario, Canada

Oct. 29—Nov. 1—San Jose, Calif. (*Civic Auditorium*)
CALIFORNIA SECTION, A.W.W.A., Secy., Henry J. Ongerth, Bureau of San. Engr., 905 Contra Ave., Berkeley 7, Calif.

Oct. 30-Nov.1—Washington, D. C. (*Sheraton-Park Hotel*)
CHESAPEAKE SECTION, AW.W.A., Secy., Carl J. Lauter, 6955—33rd St., N.W., Washington 15, D. C.

Nov. 6-8—Roanoke, Va. (*Hotel Roanoke*)
VIRGINIA SECTION, A.W.W.A., Secy. J. P. Kavanagh, District Manager, Wallace & Tiernan, Inc., 213 Carlton Terrace Bldg., Roanoke, Va.

The largest water tank repair company in the United States is at your service. Repairs guaranteed for 12 years—paint for 3 years.

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Think of it! A *one-man* machine to handle all kinds of excavating and trenching jobs. That's exactly how cities across the country are cutting costs with the Oliver Super 88 Hydro-Trencher.

This advanced compact machine travels with rubber-tired ease over busy streets and work all those tight, awkward places. Yet, there is nothing small or limited about the variety of tough jobs it handles. There's a full 49.81 drawbar horsepower with six forward speeds.

With the ½-yd. Oliver 88 Hydro-Trencher, you're equipped for fast, continuous ditching or delicate line repairs. Powerful hydraulic down pressure, deep 12-ft. working range and 170° bucket rotation get jobs done in a hurry while savings mount.

Only Oliver gives you the bonus work value of *two* complete hydraulic systems on the Hydro-Trencher for amazing control and the ability to do any *two* operations at once without pressure loss. What's more, with Oliver's hydraulic stabilizer bar, you have the stability for full loads without any tipping tendency. For swing loading work, you merely turn around the same bucket. How's that for job versatility?

Whatever your digging and loading requirements, by all means investigate the Oliver Super 88. Your choice of gasoline or diesel engines. See your Oliver Industrial Distributor for a demonstration.

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a complete line of industrial wheel and crawler tractors and matched allied equipment

W & SW

Spillway

OVERFLOW FROM THE MAIN SECTION

"Bill" Piatt is Dead

A Top Flight Engineer by Whatever Measure

William McKinney Piatt, well known consulting sanitary engineer of Durham, N. C., passed away on May 1st in Durham. He was in his 78th year.

A native of Tunkhannock, Pa. (Oct. 13, 1897), he was a graduate of Lafayette College (E. E. degree 1899 and Honorary M. S. 1902). In 1939 he was awarded the honorary degree, Dr. of Engineering, by the State College Branch of the Univ. of North Carolina.

"Bill' Piatt came south in 1899 to become associated with an earlier Lafayette graduate, Col. J. L. Ludlow of Winston-Salem, N. C. In 1910, with Gilbert C. White of Durham, N. C., he formed the engineering partnership White & Piatt. A year later he established his own consulting office, specializing in water supply, sewage disposal and power plants. In 1943 he formed a partnership with P. D. Davis, his principal assistant engineer, which partnership is being continued as Piatt and Davis by "Bill" Piatt's son, Wm. M. Piatt III, and P. D. Davis.

Mr. Piatt for three years (1918-1921) served as Water Commissioner of Durham, N. C. He served as Water Consultant to the National Resources Committee Region No. 2 and Region No. 3 during the years 1936-1943. He served as Co-architect Engineer for Camp Davis and Camp Butner and the Air-Force Replacement Center—all in North Carolina. He also reported on water supply and sewage disposal for Fort Benning, Ga.

During the depression in 1931 Piatt organized the N. C. State Committee for Trade Recovery and in 1943 he was made State Adviser for Sanitary Engineers by the War Manpower Commission.

"Bill" Piatt, a former president of the N. C. Sewage Works Assn., was a long-time member (1929-1941) of the Board of Control of the Federation of Sewage Works Assn's. He was a member of the organization committee that established the Federation in 1929. He was also a past chairman of the N. C. Section of the Am. Water Works Ass'n. and was National Director representing the section from 1943-1946. He was a member of the Am. Institute of Consulting Engineers and a Fellow in the Am. Institute of Electrical Engineers. He was a member of the Board of the Am. Society of Civil Engineers (1946-1949) and a past president of the N. C. Section of A.S.C.E. He was a charter member of the Engineers Club of Durham and its first president. He was a past president of the N. C. Society of Engineers.

"Bill" Piatt was widely admired for his ability as an engineer and for his integrity, as well as his originality as a designer of water and sewage plants. He received recognition in many forms, including the following awards:

1937—Certificate of Outstanding Engineering Achievement (N. C. Society of Engineers)

1943—Geo. Warren Fuller Award (N. C. Section of A.W.W.A.)

1949—Arthur S. Bedell Award (N. C. Sewage and Industrial Wastes Assn.)

He was a member of the honorary engineering fraternity Tau Beta Pi and the college fraternity Phi Gamma Delta. He was a member of the Soc. of Mayflower Descendants, the Sons of the Am. Revolution. He was a Life Member of the Order of Elks, a Kiwanian and an Episcopalian.

"Bill" Piatt's name will live long in the N. C. Sewage and Industrial Wastes Assn. because of the "Bill" Piatt Membership Cup which he donated to the association as a revolving award to that member securing the greatest number of new members during the year.

"Bill" Piatt rates high in our book of engineers because of his thoroughness and originality. His contributions were many in the water supply and sewage treatment field. He was always ready to give "the new" a trial and, likewise, much that was "new" was his own. He was amongst the earliest to employ electro-magnetic variable speed centrifugal pump drive, sewage solids comminution, digester gas utilization for power, sludge bed enclosure and bed heating to speed drainage and drying, continuous digester gas testing for B.T.U. values as indication of digester overloading.

"Bill" Piatt was the equipment salesman's best friend. When he saw possibilities in something new he spared no effort to make it perform as intended and almost without exception he did just that. "Bill" Piatt in our book was the type of engineer of which we could never have enough. Of her late adopted son, North Carolina has the right to be proud and will not be alone in mourning his passing.

Chicago Uses Hydrofluosilicic Acid, Not Hydrofluoric

CORRECTION ! ! !

In the April issue, an article by O. B. Carlisle described the fluoridiation system in use at the Chicago Avenue Pumping Station of the Chicago Water Works. Unfortunately, in the captions for Figure 2 and the illustrations on page 152 the words "hydrofluoric acid" were used. In all cases the word "hydrofluosilicic acid" should have been used. The error was ours, not Mr. Carlisle's.

* * *

Pickups from Purdue's "Sanitary Engineering News"

Don E. Bloodgood, Editor

There are 16,600,000 people receiving fluoridated water from 501 systems.

* * *

Twenty-five billion dollars worth of water and sewage works is seen as U. S. requirements, according to the U. S. Department of Commerce.

* * *

The general rule is that municipal officers while acting in good faith, within the scope of their authority and without negligence, are not personally liable to individuals damaged by the construction of public improvements.

W&SW

New Equipment

Universal Rain Gage

701

M. C. Stewart, Ashburnham, Mass., has available the Stewart universal rain gage. The device is a versatile, low cost, precision instrument for measuring atmospheric precipitation falling to the ground in such forms as rain, snow, sleet, freezing rain, drizzle, snow pellets, or small hail.

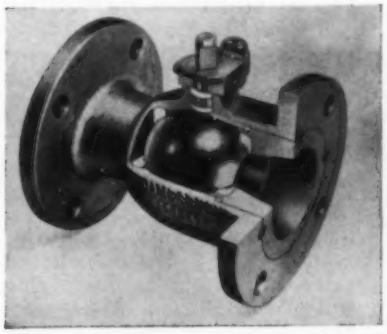
Due to its unique design and weather proof construction it is adaptable to a wide variety of uses.

All parts are made of aluminum or plastic. The unit features two portable interchangeable collector cans, so that an extra or spare can is always available. A durable plastic cap is used to cover the top of the spare collector can. At observation time only one trip out to the gage is necessary to swap the cans and the cap. A standard laboratory type cylindrical glass graduate is used for measuring the precipitation in liquid form.

Ball Valves

702

Jamesbury Corp., Worcester, Mass., has available 3 and 4 inch "Double Seal" ball valves.



According to the company, these ball valves eliminate the high turbulance and leakage tendencies found in other type valves. These valves, with their unit-body construction, have eliminated the valve bonnet which was the primary cause of leakage. This unit-body construction design assures no joint leakage points, and feature full-flow and quarter-turn operation.

The valves are made in aluminum, bronze, 316 stainless and carbon steel. Seat and seals available in Buna-N, Neoprene, "Teflon" and synthetic rubbers. Remote controlled operators can be supplied for these valves.

Universal Die Head For Pipe Threader

703

The Ridge Tool Company, Elyria, Ohio, has announced the availability of the new Ridgid 535 Pipe and Bolt Threading Machine featuring an entirely new universal die head.

The manufacturer states that this quick-opening universal die head with its 2 sets of dies threads ½″ to 2″ pipe or conduit. One set of dies threads ½″ to ¾″; the second set threads 1″, 1-¼″, 1-½″ and 2″.

The complete 535 package includes the cutting and reaming tools previously available only in the Ridgid 500 and 500A. These are a roll-type cut-off with self-centering, full-floating cutter wheel and a five-flute cone reamer with ⅛″ to 2″ capacity. Operating independently, all tools swing up out of way when not in use.

Corrosive Preventive Coating

704

Allied Porcenell, Inc., Waukegan, Ill., is now distributing Profilm, a silicate modified coating that has the appearance of paint, is applied by conventional spray equipment, yet will dry to the touch on most applications in a few minutes.

Profilm is designed for use where corrosive elements such as acids, alkalies, humidity, moisture, salt, etc., are a source of coating failure and excessive maintenance cost. It can be applied to virtually any coatable surface including metal, masonry, wood, asbestos, etc.

Profilm is available in colors and also comes in black, clear, white and metallics, in both baking and air-dry grades.

3-Inch PVC Pipe Union

705

Walworth Company, New York, N. Y., has introduced a plastic 3-inch screwed pipe union. The new union, made of highly corrosion resistant polyvinyl chloride, increases PVC piping application possibilities which have been limited by the availability of only smaller sized unions.

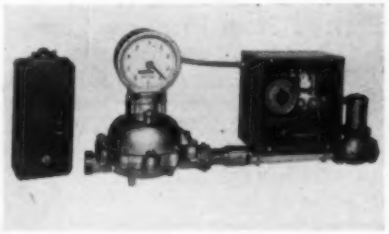
Specially designed surfaces in the joints of the three-part union provide a tight seal against flow leakage. Weighing about 1½ pounds, the union is easily handled and installed. A knurled ring provides a better grip to further simplify installation.

Coin Operated Water Vendor

706

Hydro-Control Division, Illes Power Control Co., Cleveland, Ohio, has developed a new coin operated, self-serve water vending system for township, city and county departments selling to private customers such as water delivery services, industrial users and residents in outlying areas not receiving piped water.

Known as the Self-Serve Water Vendor, the system enables cus-



tomers to obtain water day or night without the services of an attendant. The Water Vendor can be set to meter and deliver water—from 10 to 4,000 gallons—when actuated by a coin. The system can be regulated to operate with various size coins.

The Water Vendor—consists of meter, control box, solenoid valve and coin box. It is wired and completely assembled—requires connection of only two pipes and five wires to complete installation.

Improved Utility Ditcher

707

Gar Wood Industries, Inc., Wayne, Mich., has announced production of an improved Gar Wood-Buckeye Model 403 utility ditcher that incorporates foot pedal steering, a shiftable spoil conveyor and new hydraulic controls.

Specially designed for "stop and go" utility ditching, the compact 403 is now equipped with a new hydraulic pump that provides full-time hydraulic pressure for instant control of the digging boom. The new system eliminates the need for a hoist-clutch, while at the same time reduces the number of moving parts.

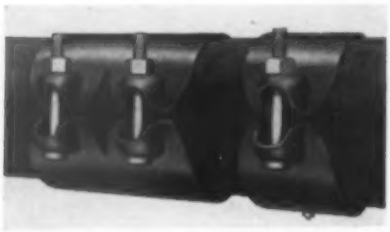
A new foot-pedal steering arrangement on the ditcher replaces hand levers, providing the operator with greater control and accuracy. An exclusive slip-clutch on the new model automatically protects the machine from overloads.

The Gar Wood-Buckeye Model 403 has a maximum digging capacity of 5 feet deep and 12 inches wide, or 4 feet deep and 16 inches wide.

Pressed Steel Economy Clamp

708

M. B. Skinner Co., South Bend, Ind., has announced a radical improvement in design, together with a new manufacturing process for the Skinner-Seal pressed steel economy clamp.



The new clamp, for repairing rust holes and corrosion spots in pipe lines, is now cold formed on a 500 ton press. The new heavily reinforced "closed" lug construction is formed from the material itself.

The width of both clamps has been increased. The "narrow" is now 4 in. wide and the "wide" is 8¼ in. wide. The same heavy 3/16 inch stock is used as before, but owing to the new lug design, the clamp has been strengthened. Sizes start at 4 in. O.D. and run through all standard steel pipe and also cast iron pipe sizes up to 24 in. O.D.

Positive, Inexpensive Curb Lock

709

Bremer Brease, Inc., Jacksonville, Fla., has developed the Bremer Curb Lock that positively controls water cut-offs.

The curb lock, developed in cooperation with the Jacksonville, Florida Water Dept., provides positive control over the problem of water "cut-offs", controls the subdivision problem, controls the vacant house problem, and eliminates the need to remove the meter when service is cut-off.

This life time unit, which will not corrode, is used when and where needed, and can be used over and over again. Thus a comparatively few locks can service a city's entire water system. It will fit any ¾ or 1 inch valve, and its simple installation requires no special crew or training. When not in use, the lock can be stored in the service truck, ready for use on the next water cut-off.

Automatic Valveless Filter

710

The Permutit Company, New York, N. Y., has developed a completely automatic gravity filter that is said to cost less than a conventional manually-operated filter and much less than a conventional automatic gravity filter, which it replaces.

The new filter is of simple, rugged construction. It consists of a vertical steel tank divided into three sections, a backwash storage space, a filter-bed compartment and a collector chamber under a false bottom.

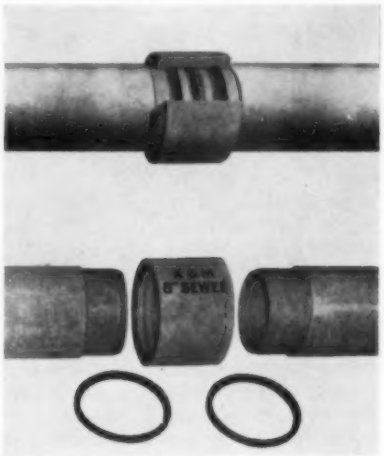
The filter-bed compartment contains standard fine filter sand supported on a collection system of disc-type plastic strainers, which provide uniform distribution of backwash water without the use of gravel. Other types of filtering media such as anthrafilt, activated carbon, Neutralite, etc., may be used by modifying the wash rate.

Where more than one filter is in operation, the flow is divided equally among all the filters by means of a flow-splitting box.

New Sewer Pipe Features Fluid-Tite Coupling

711

Keasbey & Mattison Co., Ambler, Pa., has developed a new long-life asbestos-cement sewer pipe, which features a specially designed Fluid-Tite coupling.



According to the company, this new pipe makes possible economical, non-pressure sewer systems which are installed much more quickly than ever before. Produced in 13 ft lengths, K & M sewer pipe is strong, light in weight, and can be easily handled and quickly installed even with unskilled labor.

The Fluid-Tite coupling automatically assures permanent infiltration-proof joints and is quickly assembled without use of cumbersome coupling pullers. The coupling design makes it impossible for roots to enter the joints. Assembly is a simple two-step operation. The rubber rings are lubricated and then the pipe is slid into the coupling.

New Pipe Gripping Chuck

712

The Oster Manufacturing Co., Wickliffe, Ohio, has announced that a new chuck is now being furnished on all 2 in. Oster pipe and bolt threading machines which revolve the work.

This new universal gripping chuck is operated by a hand wheel and requires no bars or tee wrenches to grip the work securely for cutting both right and left hand threads. The jaws are brought down on the work by means of the handwheel and the rocking action of the neoprene bonded insert jaws grips automatically, without hammering.

Stainless Steel Venturi Tubes

713

Vector Manufacturing Co., Inc., Jenkintown, Pa., has announced production of venturi tubes with stainless steel metering sections.

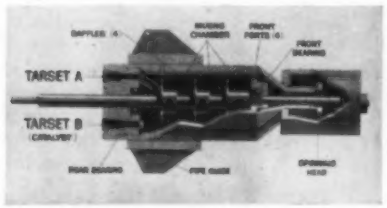
The designs have been created especially to make use of low cost production methods with stainless steel, and as a result, their cost is generally lower than conventional cast iron designs.

Two general styles are offered: a complete venturi and an insert style in which the metering section fits into the existing pipe. Designs are flexible, not being limited by foundry patterns, so can be tailored to fit any location.

Applicator For Applying Tarset To Pipe Interiors

714

Protective Coatings Division, Pittsburgh Coke & Chemical Company, Pittsburgh, Pa., has developed a new machine for applying Tarset, a coal tar-epoxy resin coating, to pipe interiors.

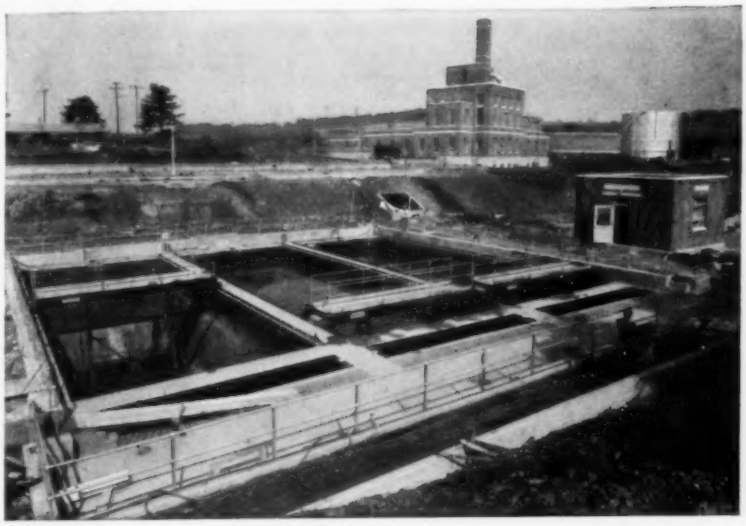


The company's applicator, is capable of laying a smooth film of Tarset on the interior of 20-foot lengths of three, four and six-inch pipe. It achieved a 15 to 20-mil thickness in a single pass.

Two novel features are incorporated in the construction of the applicator. First, the tar-epoxy blend and its catalyst are fed separately into the applicator in carefully controlled proportions. High speed mixer blades thoroughly blend the two components in the space of a few seconds. This eliminates the possibility of error and oversight as well as the problems of pot-life encountered in mixing large batches.

Second, the mixed material is expelled from the mixing chamber under positive pressure into a spinning cylinder which centrifugally casts the Tarset on the interior surfaces of the pipe. The Pittsburgh Coke & Chemical Company applicator does away with curtaining or sagging, commonly found when heavy film thicknesses are applied in one coat.

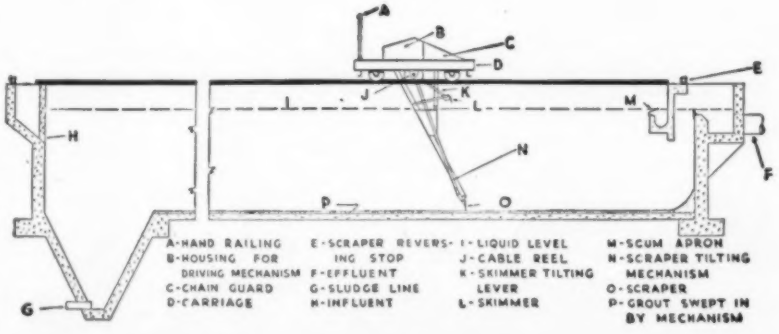
Hardinge CLARIFIERS for rectangular tanks



Three Hardinge primary clarifier units in 22′ x 68′ x 17′ tanks at the municipal sewage disposal plant in York, Pennsylvania. Other Hardinge equipment in this plant—final clarifiers, sludge thickener and digesters. (Albright & Friel, Consultants)

Hardinge has installed more than 70 rectangular clarifier units for municipal sewage treatment, oil refinery wastes and miscellaneous industrial liquid wastes—processing in excess of 300 million gallons of liquid daily.

Complete specifications for all types and sizes upon request. BULLETIN 35-D-15.



HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

Sealed Register Water Meter Features Magnetic Drive

714

Rockwell Manufacturing Co., Pittsburgh, Pa., has developed a new type of water meter that utilizes magnetic force to transmit motion from the measuring chamber to a hermetically sealed register.

In contrast to conventional water meters, the Sealed Register meter contains no stuffing box or separate intermediate gear train. The entire unit contains 15 stock

parts, of which only two moving parts operate in contact with water.

Replacing the separate gear train and stuffing box in the new meter are two permanent magnets. One magnet is contained in the oscillating piston in the measuring chamber; the other travels in the sealed register. The force between them effectively transmits motion from measuring chamber to register.

By eliminating both stuffing box and the intermediate gear train, the meter gains in both accuracy and efficiency, engineers said. The magnetic transmission is inherently frictionless.

Lack of friction permits use of instrument-type gears in the register. Because the small gears use only a small portion of the force supplied by the magnets, the register responds quickly and accurately to piston movement.

Chemical Resistant Coatings

715

The Wilbur & Williams Co., Boston, Mass., in conjunction with the E. I. duPont Co., has developed a chemical resistant coating called Rubber-Coat Liquid Hypalon. According to the company, this is the first time that Hypalon has been made available to the industrial maintenance trade in the form of a liquid brushable or sprayable film.

The unusual features of Hypalon are that it is extremely inert to almost any type of chemical attack and comes in white and bright colors so as to be easily identifiable on various pieces of equipment. Hypalon is unaffected by ozone, petroleum derivatives and other corrosive chemicals.

New Parshall Flume Unit

716

Burgess-Manning Co., Penn Instruments Div., Philadelphia, Pa., has developed a new Parshall Flume meter, which can accurately measure sewage flow, and requires little or no maintenance.

The new ML unit measures with extreme accuracy. In addition, features of its construction eliminate entirely the use of a stilling well and cover, connecting pressure piping and fittings, cleaning valve, back flushing requirements, troublesome float cable and expensive concrete construction required for a stilling well.

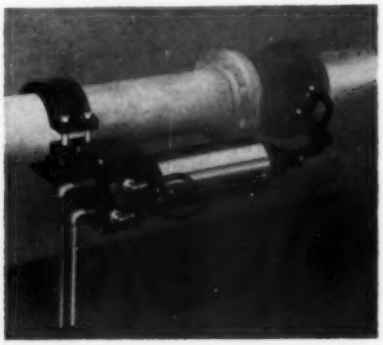
The salient features of this unit are: complete freedom from periodic cleaning of the stilling well; a 4-inch diameter stainless steel float, and float rod; a core and coil transmitting device mounted in a water-proof casting which is attached to the side of the flume or which is suspended from or attached to a crosspiece at the entrance of the flume. The float rides on the surface of the water, being immersed a distance of only ½ of an inch. The recording meter can be installed anywhere up to 3500 feet from the flume. Transmission is continuous, of the null balance inductance bridge type.

Automation For Plug Valves

717

Pantex Manufacturing Corp., Pawtucket, R. I., has developed actuators for plug valves. The actuators are designed for automatic operation, either in existing installations or for new projects.

Featuring positive complete closing and opening, the actuators are now manufactured in valve sizes from 1 to 8 inch pipe and are designed to fit all popular makes of plug valves. Actuators for 10 and 12 inch pipe sizes will be available presently.



Ruggedly built for dependable, heavy duty, long life service, these actuators are packaged assemblies and, according to the manufacturer, are delivered ready to attach to pipe and plug valve stem in a matter of minutes without special tools.

Preprimer Provides Superior Corrosion Protection

718

Tropical Paint Co., Cleveland, Ohio, has developed a Preprimer metal conditioner, that is said to provide superior corrosion protection for galvanized metal, aluminum or sandblasted steel surfaces.

Tropical Preprimer should be applied immediately after sandblasting. It forms a tight, protective film which protects the metal from rust in the interval between the sandblasting and the application of a regular metal primer. It lengthens paint life by improving adhesion of the following primer finish coats.

Applied by brush or spray with standard equipment, this one-coat metal conditioner dries to the touch in 15 minutes and should be covered within 24 hours with a regular metal primer. The product is shipped all ready to use except for thinning.

Separate Gear Unit
719

U. S. Electrical Motors Inc., Los Angeles, Calif., has announced the production of a new packaged power unit, meeting J.I.C. requirements for operations that require a standard NEMA motor mounted separate from the gear unit. The new unit, designated as the U. S. Motomount Syncrogear, uses a heavy duty, cast-iron motor support to provide easy access to the motor mounting and coupling.

Replacing the motor may be quickly accomplished, but the change is not limited to the original type of motor. If requirements change, any enclosure or explosion-proof motor of the same NEMA dimensions and rating may be used.

Pivot Headers For Aeration Processes
720

Walker Process Equipment Inc., Auora, Illinois, has developed a pivot header that permits the easy removal of selected sections of aeration systems without the nuisance of dewatering tanks.

These units enable plant operators to raise the diffusion assembly out of the tank for inspection and services. They consist of a complete assembly including Sparjer diffuser units, air header, jointed air riser, lifting boom and portable hoisting mechanism.

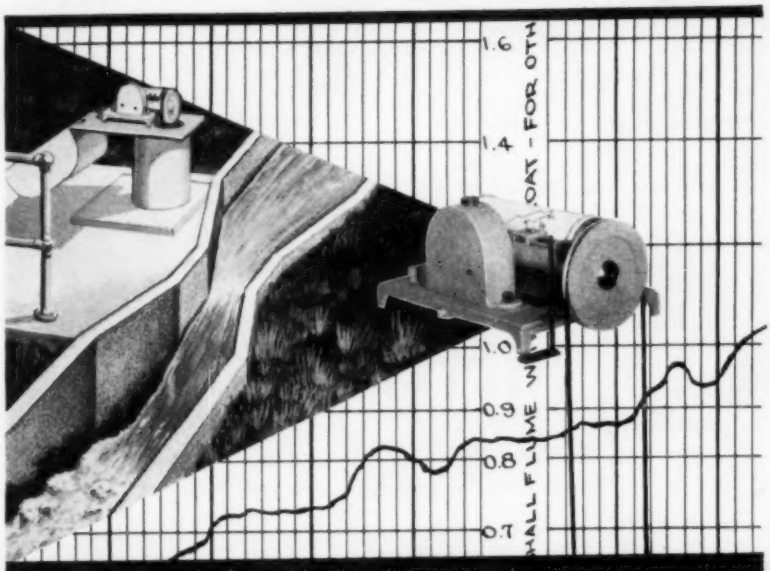
Plastic Pipe Replaces Copper At Chicago Sewage Plant
721

United States Rubber Co., New York, N. Y., in conjunction with the Metropolitan Sanitary District of Greater Chicago, has announced that ferric chloride corrosion of copper pipe, which made repair and patching leaks a continuous job at the District's Stickney Works, has been eliminated by the adoption of Uscolite pipe.

The plastic pipe was used to replace the copper piping in the 90 rotary filters of the treatment works. The installation of plastic pipe, on a test basis began in 1948, and has been extended to all the filters as continuous checking revealed no leaks or other types of damage over the years.

The rubber-resin pipe is also used to convey the ferric chloride into the sludge. The piping operates under room temperature and 30 inch maximum vacuum-type pressure.

NOW Low-Cost Automatic Flow Recording



STEVENS Type F Recorder

For Measuring Sewage, Industrial Waste and Other Flows

Flow charts directly readable in million gallons per day or gallons per minute over various sizes of Parshall flumes. The same recorder can also be used with charts reading in feet and hundredths to record head or surface fluctuations in lakes, streams and wells. Priced from $132. Write for free Bulletin 24.

The planning and efficient operation of any project which involves measurement of flowing liquids is based on flow data which can be obtained with STEVENS Water Level Recorders. STEVENS instruments are at work compiling data on hydro-electric and flood control projects and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

Experienced technical staff available for consultation on any liquid measurement installation. Write, giving description of project, and scope of data desired.

LEUPOLD & STEVENS INSTRUMENTS, INC.
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Specialists in Hydrologic Instruments for Half a Century

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invaluable for your reference file

144 pages of technical data on recorder installations, plus a wealth of hydraulic tables and conversion tables. $1.00 each. (No COD's.)

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Please rush _____ copies of the STEVENS DATA BOOK for which I enclose $1.00 each.

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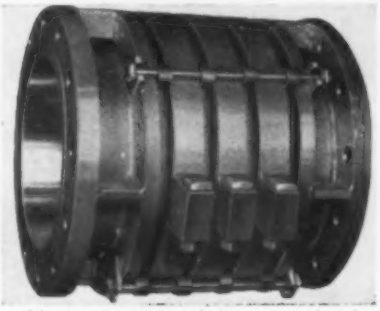
Address _____

Self Equalizing Expansion Joints

722

Zallea Brothers, Wilmington, Del., has announced a line of improved corrugated self equalizing expansion joints for piping systems.

In protecting piping and related equipment against damage due to temperature change, these new self equalizing joints employ equalizing rings to distribute pipe line expansion equally to all of the corrugations. This prevents over-compression of the corrugations beyond their design limit.



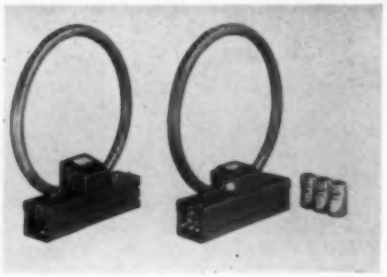
Made from stainless steel, the joints are available in sizes from 3 to 72 inch diameter in single or double units. They are used for pressures up to 300 psig and temperatures up to 1600°F. Copper self equalizing expansion joints—for use with copper and brass piping—are available from 3 to 24 inch diameter in both single and double units.

Transistorized, Miniaturized Pipe Detector

723

Oltron, Daly City, Calif., has utilized transistors and printed circuits to produce a rugged, compact, low-current-drain instrument for detecting and tracing buried pipes, valves or other metallic objects. No vacuum tubes are used.

The extremely low current drain of transistors makes extended operation possible using only three, standard-type flashlight cells as the entire power source. Transmitter and receiver units and their



associated batteries are each contained in a small, sturdy metal container designed as an integral part of the electro-statically-shielded pickup loops. Internal loop windings are impervious to moisture, hand capacity, mechanical shock or vibration. Batteries push-in, end to end, as in a conventional flashlight.

New Repair Clamp

724

Dresser Manufacturing Div., Dresser Industries Inc., Bradford, Pa., has developed a new "360" all-around pipe repair clamp that provides an easier to install, more efficient method of repairing full breaks or holes in asbestos-cement and cast iron pipe.

The exclusive sliding lug design eliminates all weak or loose parts, affording a positive leakproof seal. According to the company the "360" is easier to install than other types of repair devices—simply remove bolts from one side of the clamp, spring clamp around pipe, insert bolts and tighten nuts. A specially-compounded gasket conforms to the pipe, cushioning it from shocks and movement. The clamps are furnished in standard pipe sizes and required widths.

Rate Yourself as a

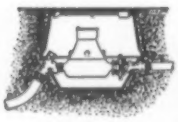
METERologist...

CHECK HERE

- ☐ Do you believe in setting water meters so that they are most available for quick and easy reading?
- ☐ Do you provide installations which put meters in the proper position and protect them from dirt and damage?
- ☐ Are your meters connected into the line so that changing can be quick and trouble-free?
- ☐ Do you test meters periodically and maintain them for maximum accuracy?

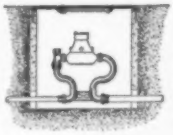
If you have checked all four you probably use Ford equipment. Don't be discouraged if your grade is off a little; the easy first step toward improving it is to send for a FORD CATALOG. IT'S FREE.

These Ford Products Make it Easy for you to be a METERologist



YOKE BOX

For shallow services the Yokebox provides protection to keep meter clean, easy to read and easy to change.

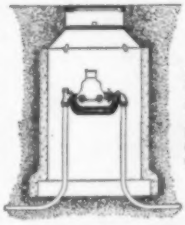


COPPERSETTER

A complete meter mounting that brings the meter up for easy reading and changing. Holds service line permanently connected.

COPPERHORN

Ideal setting for most basements with vertical service lines. Often saves more than its cost in pipe fittings.



DOUBLE LID SETTING

Provides maximum frost protection in cold climates. The Yoke holds risers permanently braced and connected for easy meter changing.

FORD FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

"We've Been Crowding That Big Drag Line All the Way..."

says Russell Thompson
General Superintendent
Noonan Construction Company
Pensacola, Florida

"... and we couldn't have handled this job at all without fast-laying

CEN-VI-RO CONCRETE PIPE!"

Cen-Vi-Ro's longer lengths really pay off when field conditions are toughest. Here, on this drainage job for the Florida State Highway Department, the soft, dry sand was caving in and filling the ditch almost as fast as it could be dug. The contractor specified Cen-Vi-Ro *for three important reasons:* (1) Longer, faster-laying lengths make it possible to keep up with the digging. (2) The longer lengths give the extra stability needed to easily maintain "line and grade" under difficult laying conditions. (3) Because of easier, faster handling and fewer joints, labor costs can be kept to a minimum.

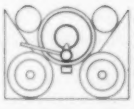
There are other advantages in using Cen-Vi-Ro Concrete Pipe... too numerous and too important to cover in this small space. Write, today, for the complete story.

At left, Russell Thompson.
At right, LaVerte Rogers, Resident Engineer, Florida State Highway Department.

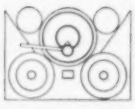
THE NAME ITSELF MEANS THE WORLD'S FINEST CONCRETE PIPE!

CEN-VI-RO

Comes from **Cen**trifugally spinning dry, "earth-moist" mixture fed into form in uniform layers.



comes from **Vi**bration of spinning form during charging. Special vibrator-tampers do this job.



comes from **Ro**lling mixture under great pressure, applied by specially designed steel roller.

Vulcan Materials Company

A Division of Vulcan Materials Company

Southern CEN-VI-RO PIPE CORPORATION

Post Office Drawer 155 • Birmingham, Alabama

W&SW

Manufacturers' News

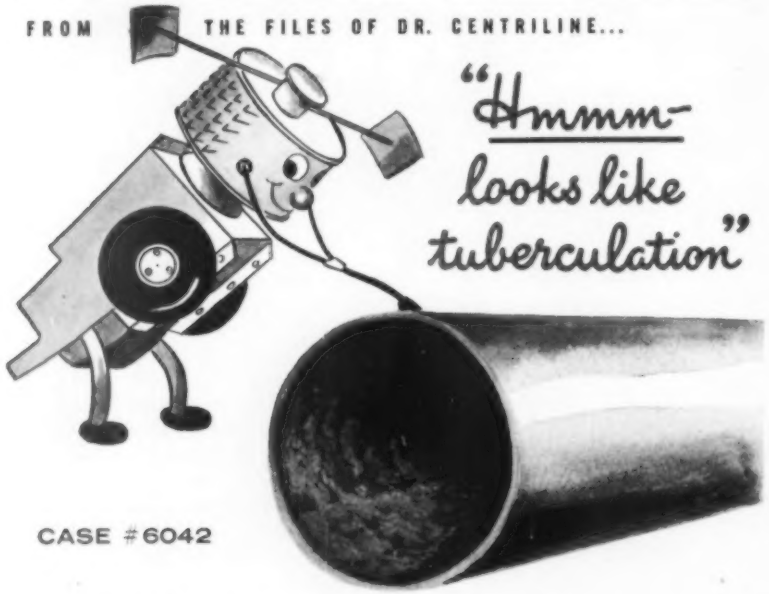
Hersey Building Meter Testing Laboratory

Hersey Manufacturing Company, Boston, Mass., has announced that the country's most complete hydraulic laboratory for testing water meters is being built by the company in its new plant in Dedham, Mass.

The laboratory will utilize water from its own wells in a 100,000 gallon underground storage system, pumped by 500-hp units through its own recirculating system.

Late this summer the firm plans to move into the new modern brick and steel building with aluminum paneling. Situated on 10 acres of land about 12 miles from Boston the new building will have 145,000 square feet of floor space.

FROM THE FILES OF DR. CENTRILINE...



CASE #6042

PATIENT: 36 miles of twin 20" Cast Iron supply lines, Portsmouth, Virginia.

SYMPTOMS: Insufficient water in Portsmouth.

DIAGNOSIS: Low pipeline capacity caused by flow restricting tuberculation.

TREATMENT: The twin 20" mains were cleaned and cement lined in place without interruption of water supply service to Portsmouth. The Centriline Process of centrifugally applying cement mortar was used.

RESULTS: Each pipeline is now capable of permanently carrying twice as much water as prior to cleaning and lining.

Examine your own capacity, corrosion and leakage problems to determine the value of the Centriline treatment to you. Cleaning and cement lining in place has been the successful remedy for almost 1,000 miles of water supply pipelines.

CENTRILINE CORPORATION

A subsidiary of the Raymond Concrete Pile Company

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WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada, and Latin America.

Komline-Sanderson Breaks Ground For New Office Building

Komline-Sanderson Engineering Corp., has announced that ground breaking ceremonies marking the start of construction on a new 10,000 sq. ft. office building were held recently at the Company's headquarters, in Peapack, New Jersey.

The one-story, brick structure will accommodate all local office and Engineering Department personnel and the Executive Offices of the Company. The building is scheduled for occupation and use in September, 1957.

Smith & Loveless To Occupy New Plant

Smith & Loveless, Inc., Kansas City, Mo., has announced that their new and expanded plant facilities will be occupied about August 1st. The company has purchased a 10½-acre site at Lenexa, Kansas, and construction of a large steel mill building is under way.

Compere Loveless, who, with B. Alden Smith, formed the firm in 1946, said the new plant will represent an investment of about $200,000. The new facility will have a 60 x 200-foot main bay and a 60 x 140-foot service bay. The main bay will have overhead electric cranes to handle loads of ten tons, as well as facilities for testing the completed product. The service bay will house shot blast booths, spray paint booths, tool crib, storeroom, electric shop, locker room, offices and utilities.

An administration building, railroad spur, employees parking lot, and access road also are included in the plans, Loveless said.

TENNESSEE CORPORATION

Ferri-Floc
FERRIC SULFATE

The Superior COAGULANT
With The Plus FACTORS–

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

Ferri-Floc TC FERRIC SULFATE

WATER TREATMENT

Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

SEWAGE TREATMENT

Ferri-Floc coagulates wastes over wide pH ranges — It provides efficient operation regardless of rapid variations of raw sewage — Is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

- Economical
- Color Removal
- Turbidity Removal
- Rapid Floc Formation
- Excellent Taste and Odor Control
- Coagulation Over Wide pH Range
- Manganese and Silical removal
- Ease of Operation
- Bacteria Removal
- Increased Filter Runs

SULFUR DIOXIDE HIGHEST QUALITY SO_2

SULFUR DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment more economically than any other chemical.

COPPER TC SULFATE

FREE BOOKLET

Let us send you without charge, a 38 page booklet that deals specifically with all phases of coagulation—just send us a postal card.

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

Hammond Iron Promotes Myers To Manager, Western Div.

Hammond Iron Works, New York, N. Y., has announced the appointment of Fred J. Myers as General Manager of the Western Division, with headquarters at the Provo, Utah offices.

Myers is well known throughout steel fabricating circles having spent the last few years as Warren, Pa., District Sales Manager. Prior to Myers association with Hammond, he was with Lukens Steel Company and before that with Welding Engineers, Inc.

Rockwell Acquires Republic Flow Meters

Rockwell Manufacturing Company, Pittsburgh, Pa., has acquired the assets of Republic Flow Meters Company of Chicago.

Republic manufactures electronic and pneumatic instruments and process control equipment for the automatic measurement and control of flow for the electrical, petroleum, natural gas, steel and chemical industries, among others. Republic manufacturing operations are centralized at Chicago, with sales offices or branches maintained throughout the country.

Present management of Republic will remain unchanged, with James D. Cunningham, founder of the company and one of Chicago's leading industrialists, continuing as president. W. F. Crawford, president of Edward Valves Inc., a Rockwell subsidiary, will be associated with the Republic management in Chicago.

W. R. Meadows Promotes Johnson and Stilling

W. R. Meadows Inc., Elgin, Illinois, has announced the appointment of Mr. T Ray Johnson as Vice-President in charge of sales, and Mr. Robert G. Stilling to general sales manager.

Mr. Johnson has served as general sales manager since joining the firm in 1949. He posses an outstanding background of over 25 years experience in this field and has been responsible for the development of many premoulded asphaltic products for the paving and building industry.

Mr. "Bob" Stilling joined the company in 1947 after receiving his BA degree at Lake Forest College. He spent several years in the field as a Sales-Engineer until he was appointed assistant sales manager two years ago.

Grier Joins W-K-M

W-K-M, Houston, Texas has announced that Wendell Grier has joined the company as Eastern Sales Representative for the ACF Lubricated Plug Valve Department. His territory will include Eastern Pennsylvania, Delaware, Maryland, Virginia, and Southern New Jersey.

Before coming with W-K-M-, Mr. Grier was with the Bethlehem Steel Company for fifteen years as buyer of valves and heavy industrial equipment.

AS NEAR AS PERMANENT
The R. D. WOOD Standard Swivel-Joint Hydrant
R. D. Wood Hydrants are available with mechanical joint or flange-type pipe connections. Also with O-Ring Seal when specified (shown below).

New Subscription Order Card

NOTE THE NUMBERS
they correspond with the
headings in our
EQUIPMENT AND LITERATURE COLUMNS
To receive further information
on any of the listed
EQUIPMENT OR LITERATURE
just circle the corresponding
numbers on the card
Fill in your name, address, title
and mail!
For your convenience these
cards require no postage.

Water & Sewage Works

185 NORTH WABASH AVE. CHICAGO 1, ILL.

Gentlemen:

Please enter my new subscription to WATER & SEWAGE WORKS for the period checked below:

☐ Three Years—$10.00 ☐ Two Years—$7.50 ☐ One Year—$5.00

Above rates are for U.S.A. and Canada. Add $1.50 per year for other countries.

Name ..... Title or Position .....

Company or Govt. Dept. .....

Address .....

City ..... Zn. ..... State .....

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708	709	710	711	712	713	714
715	716	717	718	719	720	721
722	723	724	725	726	727	728
729	730	731	732	733	734	735

IF YOU WISH TO RECEIVE FURTHER INFORMATION ON PRODUCTS ADVERTISED OR REFERRED TO IN THE ARTICLES, OF THIS ISSUE—LIST THE PAGE NOS. BELOW.

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BUSINESS REPLY CARD

First Class Permit No. 43608, Sec. 34.9, P.L.&R., Chicago, Ill.

WATER & SEWAGE WORKS

185 NORTH WABASH AVENUE

CHICAGO 1, ILLINOIS

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

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WATER & SEWAGE WORKS

POST OFFICE BOX 123

BALDWIN, NEW YORK

Postage Will Be Paid by Addressee

New Subscription Card

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WATER & SEWAGE WORKS

JUST
CLIP
THESE
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ISSUE

READER SERVICE CARD for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

Hagan Chemicals to Move Headquarters

Hagan Chemicals & Controls, Inc., Pittsburgh, Pa. will move its headquarters offices and research center from downtown Pittsburgh to a 27-acre site on the Penn-Lincoln Parkway West early in the summer of 1958.

The move to the suburban site was decided after months of study by the company and by outside consulting firms. About 500 persons will be moved to the new Parkway offices which will be 10 miles from the downtown area. The company will soon begin construction on two new buildings which will cost approximately $1,750,000.

The new office building will be an L-shaped two-story structure with 60,000 square feet of space. The main entrance facing old Route 22-30 and the wing facing Campbell's Run Road.

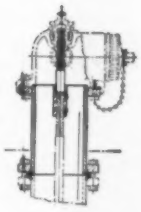
The research center facing the Parkway will be rectangular in shape with floor space of 33,000 square feet. Parking space will be available for more than 600 cars.

YOU CAN GET TO A LOW-COST INSTALLATION

This hydrant will give you reliability, strength and permanence at lowest possible cost. It assures your community of water delivered at top pressure, because internal friction is reduced to the minimum. Generous size of all water carrying areas, carefully rounded changes of diameter, and scientifically tapered nozzleways all contribute to reducing friction well below A.W.W.A. specifications.

EXTENSION PIECE

The extension piece may be inserted (without shutting off water supply) between hydrant head and barrel or between barrel and elbow.



BREAKABLE FLANGE AND STEM COUPLING

Available at slight extra cost and designed to snap under a blow which would otherwise smash the hydrant beyond repair, thus depriving the community of fire protection for a dangerous length of time. Flange and stem coupling can be replaced in a jiffy *without excavating.*

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

Infilco Forms New Industrial Department

Infilco Inc., Tucson, Arizona, has announced the formation of a new department of industrial water and waste treatment, and the appointment of Mr. G. E. Hauer to head up the department.

Mr. Hauer, a graduate of University of Michigan, was engineer and chemist for the city of Grand Rapids, Michigan before he joined the General Chemical Division of Allied Chemical and Dye Corp. Most recently he has been vice-president of American Well Works.

The new division will handle the special applications of the company's equipment for liquids treatment in the rapidly expanding industrial field. Working in close cooperation with Infilco's Research and Development Dept., the new division will study marketing techniques and special promotion of developments in the fields of water and waste treatment.

Carroll Elected Neptune Vice President

Neptune Meter Co., New York, N. Y., has announced the election of John J. Carroll as vice president of the company.

In his new position, Mr. Carroll will assume direct, over-all responsibility for sales of all Neptune meters, including Trident water meters, Red Seal petroleum meters, Neptune industrial meters, and Superior gas meters.

Mr. Carroll succeeds Wentworth Smith, who has been named executive in charge of all meter operations for Neptune.

Mr. Carroll joined Neptune in 1937 as a sales representative in Indiana, and in 1949 was appointed district manager of Neptune's Louisville, Ky. branch. He became assistant to the general sales manager in 1952, and was named general sales manager in 1954.

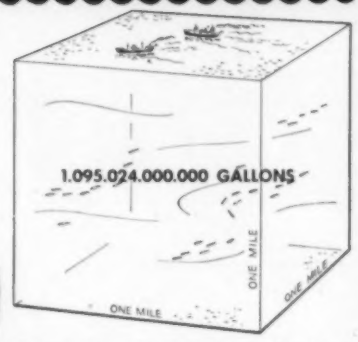
Sparling Meters

FOR INFALLIBLE MEASUREMENT OF WATER

Want a cubic mile of water metered?

That's a colossal volume—'way over 3,000,000 acre feet—but Sparling Meters in total use measure far more than that every year.

The propellered meter



Meters for all capacities—2" to a river. Open or closed flow. Local or remote recording.

SPARLING METER COMPANY INC.
225 N. Temple City Blvd., El Monte, Calif.

ATLANTA 3, 66 Luckie St. N.W.
CHICAGO 4, 220 So. State St.
CINCINNATI 2, 626 Broadway
DALLAS 1, 505 No. Ervay St.
KANSAS CITY 6, MO., 6 E. Eleventh St.
LOS ANGELES 54, 945 No. Main St.
ROSELLE, N. J., 650 First Ave. West
SAN FRANCISCO 24, 85 Industrial St.
SEATTLE 99, 904A Elliott West
TORONTO, CAN., 207 Queens Quay West
ROMFORD, ENGLAND 248 London Rd.

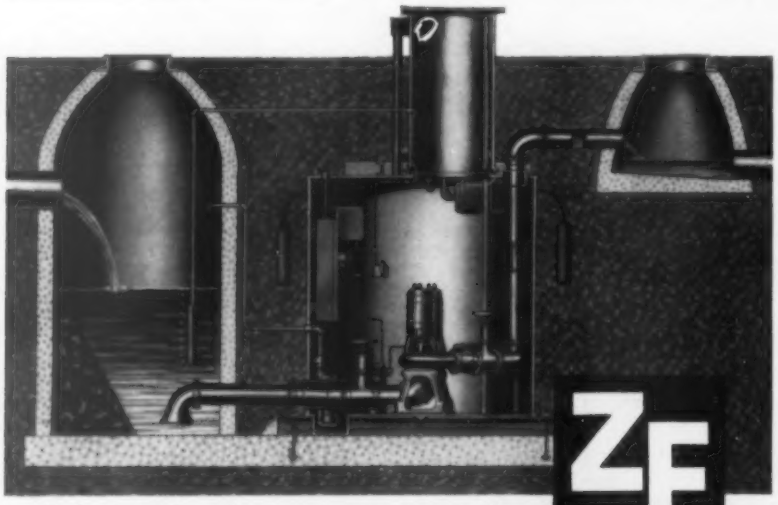
REQUEST FOR LITERATURE

Sparling Meter Company, Inc.
225 N. Temple City Blvd., El Monte, Calif. WSW-7

NAME _____

ADDRESS _____

CITY _____ STATE _____



ZF

Before engineering your sewerage system consider the advantages of this...

PREFABRICATED PUMPING STATION

- Installation can be made with a minimum of time and cost.
- Can be installed on existing public property.
- Entire unit is prefabricated and shop-fitted with standard, well-known equipment.
- Usually can be located at most advantageous spot for existing gradients.
- It is feasible to move and relocate should conditions change.
- Improved equipment, controls and prefabricating technique make the Z-F Station an economical and reliable unit. Write for details.

(Territories open for representatives)

Manufactured by ZIMMER & FRANCESCON, Moline, Illinois

Diamond Alkali Adopts New Trademark

Diamond Alkali Co., Cleveland, Ohio, has announced the adoption of a distinctive new trademark which will henceforth be used to identify its corporate organization and chemical products.

The new mark, called the "Chemical Diamond", has been designed to provide originality and visual recognition values of the company's products. Carrying a diamond as an integral part of itself, the design effectively frames this conventional shape without in any way suggesting similarity to a multitude of other trademarks incorporating or utilizing diamonds.

Taylor Promoted By Bailey Meter

Bailey Meter Company, Cleveland, Ohio, has announced that James W. Taylor has been named manager of the company's Milwaukee district.

Taylor, formerly acting manager, was graduated from Pennsylvania State University in 1950, with a degree in fuel technology. He joined Bailey Meter in 1953.

Rockwell Expands Valve Research Program

Rockwell Manufacturing Co., Meter & Valve Division, Pittsburgh, Pa., has announced an expanded program of valve research and development.

Included in the enlarged program will be work on automatic lubricators; hydraulic, pneumatic and electric valve operators; coated and high pressure valves; valves for vacuum service; improvement of test methods; and practical methods of producing vacuum-processed metals.

Laboratory equipment includes two high pressure test stands with special hydraulic piping; special maximum-pressure indicating

gauges; pneumatic and hydraulic cycling cylinder; etc.

Kenco Moves Into New Plant

Kenco Pump Division, a division of the American Crucible Products Co., Lorain, Ohio, will soon be completely situated in a new plant.

The building is located at 1502 W. 13th St., Lorain, Ohio, a block away from the former plant. Construction began in November, 1956, and the plant was largely completed by late February, 1957.

The plant consists of approximately 12,000 square feet of floor space, and is headquarters for the following Kenco Pump Division facilities: design, administration, manufacturing, engineering, service, warehousing, shipping and sales.

Chain Belt Appoints Three Regional Managers

Chain Belt Company, Milwaukee, Wis., has announced the appointment of three new regional managers for its eastern, midwest, southern and north-western territories. It also announced the assignment of six new district sales managers and the establishment of a district sales office at East Orange, New Jersey.

Mr. J. B. Roberts was appointed Eastern Regional Manager and will make his headquarters at the new East Orange, New Jersey office. He joined the company in 1921, moved to the New York office in 1932 and has been district sales manager there since 1945.

Mr. William Sivey has been appointed Midwest and Southern Regional Manager with headquarters in Milwaukee. He joined Chain Belt in 1945, and opened the district sales office in Philadelphia and has been district manager there since that time.

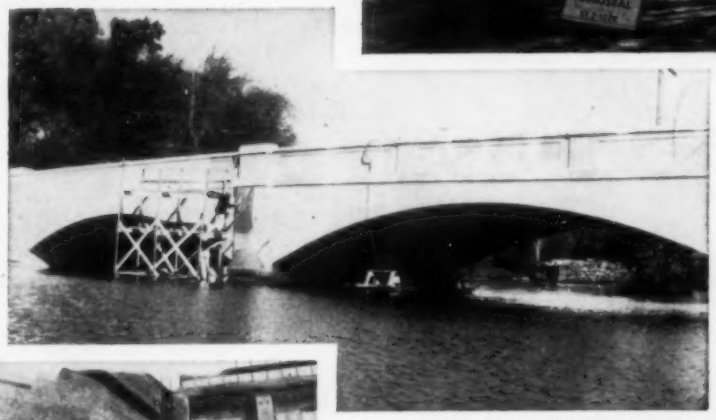
Mr. H. F. Bergis will be Northwestern Regional Manager with headquarters in Portland. Bergis has been with Chain Belt since 1923 when he joined the Seattle office. He became district manager of the Portland office when it was started in 1931.

View of an Optimist

ULCERS: Something men get from "mountain-climbing" over molehills.

It's *New Again* with THORITE and THOROSEAL

Freeze-thaw cycle following water and moisture penetration, also swelling of reinforcing rods from moisture contact, cause masonry destruction.



BRIDGE OVER CONCORD RIVER
ROUTE 3, BELLERICA, MASS.

Workmen on scaffold patch spalled and cracked concrete with THORITE and seal surface with THOROSEAL.

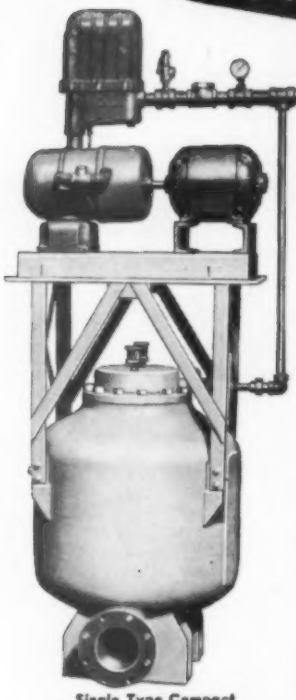
Area at left chipped to sound masonry. It will then be patched with THORITE *Nonshrink, Nonslump 20-Minute Set Patching Mortar*, without necessity of costly forming, finished by application of Thoroseal.

Request Circular No. 16 and 20.

Write for our 16 page "How to Do It"

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNSYLVANIA · CENTERVILLE, INDIANA

NO! NO! NONE!



Single Type Compact Self-contained Ejector System

NO *Complex Piping*.....**NO** *Screens*
NO *Impellers*.....**NO** *Shredders*
NO *Costly Pump Cleaning*

When You Use
BLACKBURN-SMITH
SEWAGE EJECTORS

- Save money on installation, operation or maintenance costs.
- Put in automatically controlled BLACKBURN-SMITH PNEUMATIC SEWAGE EJECTORS.
- Lift sewage 150 feet at 30 to 500 gpm without failure, mess or big bills. Rugged. Simple. Economical. Sanitary.
- Write for Bulletin S-50 showing application, advantages, dimensions and layouts of B-S Pneumatic Sewage Ejectors for single or duplex systems.

Blackburn-Smith Mfg. Co., Inc.
51 GARDEN ST. HOBOKEN, N. J.
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GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

Write FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.
FLORENCE, ALA. 315 So. Court Street

OTHER OFFICES IN
CHARLOTTE, N. C. Liberty Life Bldg.
CHICAGO, ILL. 33 N. LaSalle Street
NEWARK 5, N. J. 193 Emmet Street

Rockwell Opens Valve Museum

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced the opening of a unique valve museum, recounting the history of lubricated plug valve development, at its Barberton, Ohio manufacturing plant.

Displayed in the museum are drawings, cutaways and working models showing the progress in designs and types from Sven Nordstrom's original lubricated plug valve of 40 years ago to today's highly developed models.

Some 52 Rockwell-Nordstrom lubricated plug valves are arranged in chronological order on a three-tier display.

Beckman Instruments—Statham Laboratories Merge

Beckman Instruments, Inc., Fullerton, Calif., and Statham Laboratories, Inc., Los Angeles, Calif., have jointly announced that agreement has been reached to merge the two firms.

The transaction will involve a stock exchange of up to 400,000 shares of Beckman for all of the Statham interest. It was also stated that the merger will result in increased earnings per share for the current Beckman fiscal year as well as for future years.

Chicago Pump Wins Judgment Against Baytown, Texas

Chicgo Pump Co., Chicago, Ill., has announced that the United States District Judge for the Southern District of Texas, Houston Division, has entered judgment in the suit filed by the Chicago Pump Co. against the City of Baytown, Texas.

The decree held Chicago Pump Company Patent No. 2,532,457 for the aerated grit removal chamber valid and infringed by a grit removal installation owned by the City of Baytown.

W&SW

New Literature

Power Operators For Rockwell-Nordstrom Valves

725

Rockwell Manufacturing Company, Pittsburgh, Pa., has just issued a 4-page bulletin presenting a complete line of Westinghouse **Air Brake Power Operators** for actuating Rockwell-Nordstrom screwed-gland type, wrench-operated valves.

Size, cylinder diameter, cylinder stroke and list price are included in a listing of operation conditions involving: (1) full valve rating line pressure and 90 psi cylinder pressure, (2) ½ valve rating line pressure and 50 psi cylinder pressure, (3) ½ valve rating line pressure and 90 psi cylinder pressure, and (4) ¼ valve rating line pressure and 50 psi cylinder pressure.

The operators are described as consisting of a cylinder, mounting bracket, radius arm and clevis bracket. They are mounted easily on the valve cover and can be operated with water, oil, gas or air at pressures up to 200 psi.

Turbine Flow Meter

726

Fischer & Porter Company, Hatboro, Pa., has announced the publication of a catalog on the **F&P Turbine Flow Meter.** The catalog describes how the motor is inserted directly into process piping, and can measure the rate of flow of a variety of liquids having flows of from less than one gpm to more than 2500 gpm. Accuracy of the F&P meter is high; ±½% of instantaneous rate under production conditions.

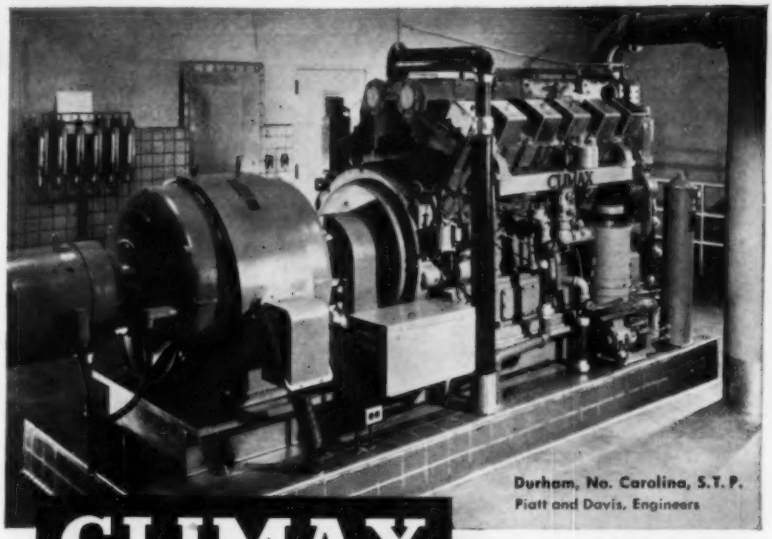
According to the catalog, the F&P meter is so designed that mounting in any position has no effect on the flow coefficient. Special thrust plates, installed in both front and rear hub assemblies, guard against the effects of reverse flow. Due to simplicity of design the F&P Turbine Meter may be disassembled and reassembled without the necessity for re-calibration.

Sewage Treatment Equipment

727

Dorr-Oliver Incorporated, Stamford, Conn. has announced the

(*Continued on page* 122*A*)



Durham, No. Carolina, S.T.P.
Piatt and Davis, Engineers

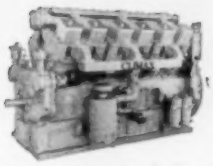
CLIMAX

POWER

FOR SEWAGE TREATMENT PLANTS...

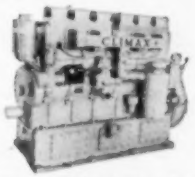
Climax engines can be found on the job every day of the year in hundreds of sewage treatment plants from coast to coast—powering sewage pumps, blowers and generators. Tremendous savings are being realized by using readily available **sludge gas** for fuel and also by utilizing heat from the jacket water and exhaust gas of the engines to heat digesters and buildings. When a shortage of sludge gas is encountered these engines operate on an auxiliary fuel—either gasoline, butane or natural gas, or a combination thereof. Eight Climax engines are available for continuous duty service in Sewage Plants in a range of sizes from 40 to 300 hp.—for standby service up to 605 hp. max. rating.

Write today for complete information, bulletins or engineering consultation.

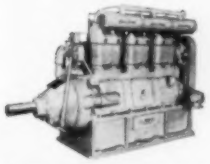


V-125—12 cylinder, 605 max. H.P. at 1200 R.P.M.
V-122—12 cylinder, 520 max. H.P. at 1200 R.P.M.

V-85—8 cylinder, 390 max. H.P. at 1200 R.P.M.
V-80—8 cylinder, 340 max. H.P. at 1200 R.P.M.



K-75—6 cylinder, 302 max. H.P. at 1200 R.P.M.
K-67—6 cylinder, 265 max. H.P. at 1200 R.P.M.



R-165—6 cylinder, 192 max. H.P. at 1200 R.P.M.
R-110—4 cylinder, 130 max. H.P. at 1200 R.P.M.

CLIMAX ENGINE MANUFACTURING CO.
208A South LaSalle Street • Chicago 4, Illinois
Factory—CLINTON, IOWA • District Office—DALLAS, TEXAS

availability of a new, four-page two color bulletin on **The Dorr-Oliver SpiroVortex System.**

This bulletin describes the principle of design, operation and advantages of this latest development for complete treatment of domestic sewage as well as the equipment units employed in the flowsheet. Installation photographs, a typical plan flow diagram and a list of installations to date are also included in this bulletin. According to the bulletin the SpiroVortex System is a newly developed treatment method which operates on the same principle as the activated sludge process. It will produce a treatment effluent from which over 90% of the raw sewage B. O. D. has been removed.

Irrigation Meters
728

Sparling Meter Co., Inc., Los Angeles, Calif., has just released a factual 28-page brochure on **Sparling Irrigation Meters.**

The brochure presents full color views of meter applications, and contains accuracy and head loss curves. The complete line of irrigation meters is presented with detailed cross-sectional views, specification tables, performance curves and modifications. Meters for portable or permanent settings are shown.

Included in the brochure are illustrations of various settings of meters in horizontal, vertical and angled positions in relation to main laterals, pump suction or discharge, canals and flumes, farm deliveries into ditches, tanks or reservoirs and simple gravity turnouts.

Fluo-Chlorinator
729

Fischer & Porter Company, Hatboro, Pa., has issued a Catalog on its **Fluo-Chlorinator** which adds controllable quantities of fluoride and chlorine solution to potable water supplies.

According to the catalog, addition of both chemical solutions may be simultaneous or each may be added independently of the other. The same quantatative control can be exercised when either method is used. It discusses the advantages of the new unit such as a positive air break to prevent syphoning; uniform addition of the chemical solutions without pulsation; and easy installation and maintenance. Methods of control are optional and include manual, semi-automatic, automatic, and multiple rate.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

Synonym for...

PURE WATER

ROBERTS FILTER
MANUFACTURING CO.
607 COLUMBIA AVE.
DARBY, PA.

switch to
Anthrafilt
Trade Mark Reg. U.S. Pat. off.

THE MODERN ALL-PURPOSE
FILTERING MEDIUM

Best for All Types of Filters

ANTHRAFILT
offers important advantages over sand and quartz

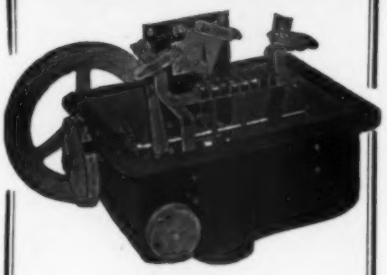
DOUBLES length of filter runs.
REQUIRES only half as much wash water.
KEEPS filters in service over longer periods.
INCREASES filter output with better quality effluent.
GIVES better support to synthetic resins.
PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, order, etc.
IDEAL for industrial acid and alkaline solutions.
EFFECTIVE filtration from entire bed.
LESS coating, caking or balling with mud, lime, iron or manganese.

Write for further information, test samples and quotations to:

PALMER FILTER EQUIPMENT CO.
P. O. Box 1696—822 E. 8th St., Erie, Pa.

Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg.,
Wilkes-Barre, Pa.

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 Hampden Ave., St. Paul 4, Minn.

International Exhibition for Water Purification and Waste Water Treatment from 25th Jan. to 2nd Febr. 1958 in the Swiss Industries Fair, Basle

First exhibition of its kind in Switzerland in conjunction with an Congress dealing with the treatment of industrial waste water

The exhibition will consist of the following groups:

- Purification of drinking water and of water for industrial purposes
- Purification of waste water
- Mechanical auxiliary equipment
- Pumps, measuring and control equipment
- Chemical and technical accessories
- Construction of conduits (cast-iron, steel, cement, stoneware)
- Laboratory equipment

Additional information can be obtained from the Association for the Protection of Rivers and Waterways in North-West Switzerland, 6 Binningerstrasse, Basle, (Switzerland)

Sewer Pipe Jointing Material
730

K. T. Snyder Co., Houston, Texas, has just published a catalog on **Root-Seal,** a hot pour plastic base sewer pipe jointing compound.

The catalog contains illustrations and descriptive material on 5 different actual installations using Root-Seal, and presents the results obtained. The features and ease of application are explained in detail. An estimating table showing pounds per joint required, and a set of sample specifications complete the catalog.

Pipe Friction Losses Slide Calculator
731

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has available a handy pocket slide calculator for figuring water pipe and paper stock **Pipe Friction Losses.**

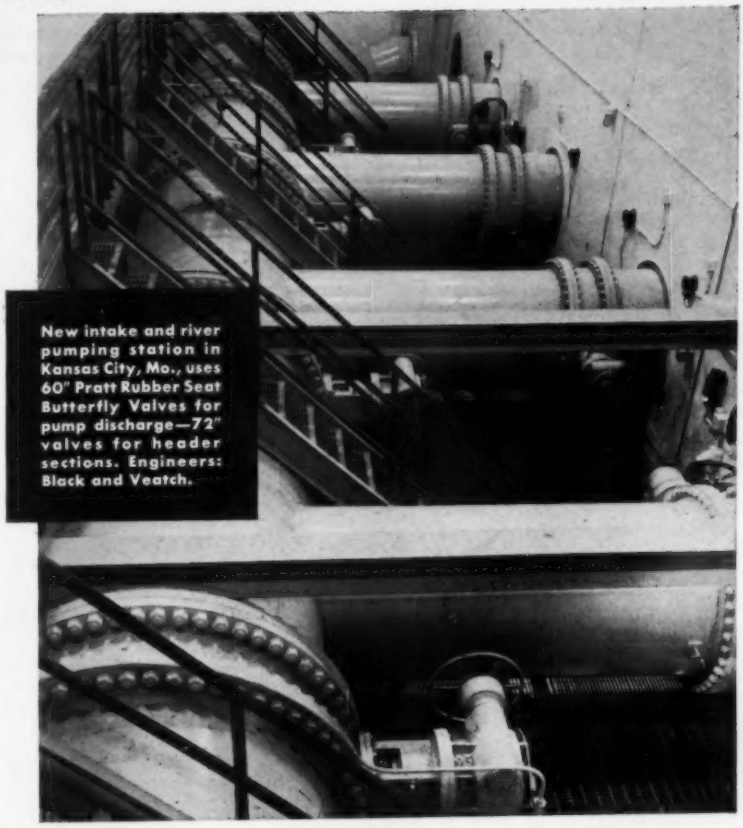
Data for computing water pipe friction loss are based on standards of the Hydraulic Institute and appear on one side of the calculator while those for determining paper stock pipe friction loss are on the other side. The latter are based on accurate test data obtained by Allis-Chalmers and adapted by the Hydraulic Institute for handling Canadian sulphite and ground wood raw stocks of various consistencies in cast iron pipe.

Measuring 9-¼ by 4 inches, this practical calculator also carries a table of equivalent lengths of new straight pipe for valves and fittings for turbulent flow. This pocket calculator available free only when requested on company letterhead.

Plastic Pipe & Fittings
732

Franklin Plastics, Inc., Franklin, Pa. has published a new 16-page catalog describing their complete line of **Dur-X Plastic Pipe, Tubing and Fittings,** including NSF-approved Supreme Pipe and Fittings. Complete data and specifications for three grades of polyethylene pipe are included with descriptive information on physical properties.

The new catalog also contains instructions and suggested methods for installation of plastic pipe and typical applications for plastic tubing. Franklin's full line of high-impact styrene alloy fittings is also detailed in drawings and photographs with data on sizes, weights, and applications.



New intake and river pumping station in Kansas City, Mo., uses 60" Pratt Rubber Seat Butterfly Valves for pump discharge—72" valves for header sections. Engineers: Black and Veatch.

KANSAS CITY:

Rugged efficiency in a minimum space

Look! A modern pumping station with compact, unobtrusive large-diameter valves that require no more clearance than a standard pipe flange, and operators that are equally compact. Face-to-face dimensions of these 60" and 72" diameter Henry Pratt Rubber Seat Butterfly Valves are only 15" and 18" respectively.

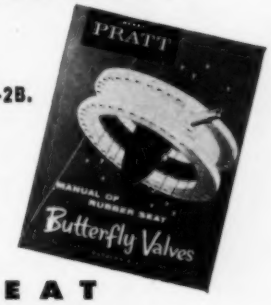
Specifying Prat. valves means important savings in space and installation costs—but even more important, economy through years of efficient maintenance-free operation.

Pratt originated the Rubber Seat Butterfly Valve and has installed more of them than any other manufacturer.

For valve design with a 50 year reputation for practical imagination, see Henry Pratt.

NEW! Latest, most accurate pressure drop and flow data, conversion tables, discussion of butterfly valve theory and application plus other technical information.

Write for Manual B-2B.



HENRY PRATT

RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

Rubber Sewer Pipe Joints

733

Hamilton Kent Manufacturing Company, Kent, Ohio, has published a 20-page booklet in color describing **Tylox Rubber Gaskets** for leak-proof coupling of concrete and vitrified clay sewer pipe.

Of special interest to engineers, contractors, public officials and others concerned with designing, financing and constructing sewerage and drainage systems, the booklet gives the history of the development of rubber joints, and complete engineering and application data on Tylox.

The booklet contains illustrated case histories of Tylox installations in America, and in countries abroad. Included also, are suggestions to assist engineers in specifying Tylox Joints for both tongue and groove and bell and spigot types of sewer pipe.

Waste Treatment Equipment

734

Chain Belt Company, Milwaukee, Wis., has just published a bulletin containing a general description of the company's line of **Waste Treatment Equipment.**

The illustrated bulletin outlines various methods of waste treatment such as: screening, grit removal, sludge removal, settling, skimming, flocculation, and flotation.

Waste treatment equipment for large and small industrial and sewage plants is covered. The bulletin is general and literary in style, rather than technical. It is designed to give the reader a "short-course" on the products and processes employed by the company in the field of industrial and municipal waste treatment.

Vertical Service Pumps

735

Layne & Bowler, Inc., Memphis, Tenn., has just released a six page, five color bulletin describing **Layne Short Coupled Vertical Service Pumps.** It explains the many uses of service pumps, including suggested installation plans, existing installations for municipal and private water works systems.

Among the advantages listed for use of short coupled vertical pumps are: lower installation costs, reduced floor space, no priming necessary, no danger of flooding and low maintenance and power costs.

Fume Hoods

736

Kewaunee Mfg. Co., Adrian, Michigan, has just published a new 48-page catalog devoted exclusively to **Fume Hoods.**

Profusely illustrated with installation photographs, product pictures, elevation and roughing-in drawings, it includes extensive engineering data and recommendations, operating characteristics, and operating cost comparisons. Covering every size and type of Fume Hood, including conventional, Airflow, portable and walk-in types, the catalog introduces a new Airflow Thinwall series which provides 5 inches more working space in 4 inches less room space.

Low-Cost Dewatering

737

The American Dewatering Corporation, New York, N. Y., has just issued a new catalog on **Low-Cost Dewatering.**

The catalog sets forth the advantage of contract predraining of excavations. It is also generously illustrated with photographs of interesting jobs of various types.

FULL AUTOMATIC
Engine Controls

Model 1436M4

SYNCHRO-START Engine Controls provide automatic start and stop from any type of remote pilot switch. Interrupted cranking periods with total time limit of cranking is a regular feature.

Standard Controls are available which provide FULL PROTECTION for the engine. The model shown will light an individual signal and operate an external alarm in event the engine fails to start. Should low oil pressure, high water temperature, and overspeeding occur while running, the engine will stop and Visual Signal will indicate source of trouble.

Additional safety features can be incorporated on special order.

These controls can be used with Diesel, Gasoline, and Gas engines.

Request Bulletin 501

Synchro-Start Products Inc.

8151 N. RIDGEWAY AVE. • SKOKIE, ILL.

LUMETRON
Colorimeter
Mod. 450
for
Nessler
Tubes

A new photoelectric instrument of high accuracy for the measurement of pale colors and faint turbidities.

- For all analytical colorimetric determinations in which only a slight coloration can be developed.
- For sanitary examination of drinkable water and for analysis of water for municipal and industrial purposes.
- For color standardization of lightly colored liquids such as kerosenes, sugar solutions, solvents, varnishes, liquid waxes, vegetable oils, beverages, cosmetics.
- Replaces visual color comparison in Nessler tubes.

Write for literature to

PHOTOVOLT CORPORATION

95 Madison Ave. New York 16, N. Y.

Semi-Steel Valves

738

Rockwell Manufacturing Company, Pittsburgh, Pa., has issued a completely revised 43-page bulletin covering the entire **Rockwell-Nordstrom Semi-Steel Valve** line.

The new bulletin, which supercedes a 35-page earlier edition, has a number of entirely new features including: (1) two full pages of photos, drawings and detailed description of Rockwell-Nordstrom lubricants and lubricating methods; and (2) large cutaway photos showing in detail the working parts of four principal types of Rockwell-Nordstrom semi-steel valves—two-bolt cover, screwed-gland, bolted-gland, and multiport types.

Other new features include dramatic new highlighted photos and larger easier-to-read specifications tables—and photo-illustrated descriptions of all new semi-steel models added to the line in the past four years.

Diaphragm Valves

739

Hills-McCanna Company, Chicago, Illinois, has just published a new 12-page-2 color catalog covering **Hills-McCanna Diaphragm Valves.**

This new catalog describes the exclusive features of Hills-McCanna Diaphragm Valves for positive closure and the latest in Plastic Valves and Diaphragms for corrosive services. A quick reference chart for diaphragm material selection is also included. Dimensional specifications for several valve models are also shown.

Wheel Ditcher

740

Barber-Greene Co., Aurora, Ill., has just published an attractive, 8-page, two color folder, describing the new **Model 774 Wheel-Type Ditcher.**

The several exclusive features of the Model 774 are all described in diagrams and photographs in the new brochure. Among the features described are: A unique flexible connection between chassis and digging wheel; A new concept in digging wheel drive through a floating differential; Hydraulic spoil conveyor drive and wheel hoist; Barber-Greene's exclusive "Hydra-crowd," finger-tip control of an infinite range of forward crowding speeds and; Improved simplified crawler design.

A double-page spread illustrates the manner in which these features, and many more, are related to the design and operation of the Model 774.

Three pages of job pictures show the Model 774 at work under a variety of conditions from Spring mud to 26° below Zero temperatures and on a range of job applications showing the machine's abilities in virtually every field in which this type of ditcher is applied.

Pocket Size Laboratory Safety Manual

741

Fisher Scientific Co., Pittsburgh, Pa., has just published a compact, pocket-size, fully illustrated **Manual of Laboratory Safety.**

The manual covers accident prevention, first aid, fire prevention, and safety equipment, and concludes with a safety bibliography. It also has a section on handling radioactive materials, as well as the use of isolation units for hazardous microbiological and clinical procedures.

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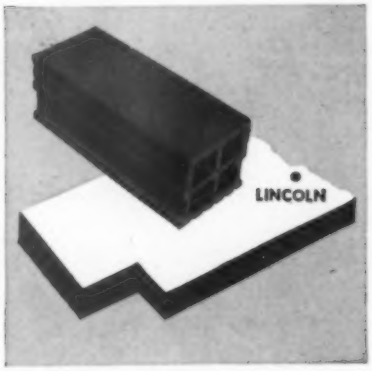

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*Leopold Bottoms also used for 12 mgd construction in 1949

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Weather-Protected Motor

742

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin that features the **Allis-Chalmers Weather-Protected Motors.**

According to the bulletin, these motors, built to meet defined NEMA requirements, feature a sturdy steel frame, a removable pre-wound stator assembly, proven insulation, capsule-mounted split sleeve bearings, removable air ducts, and protective screens. The bulletin also states that these motors are available with "Silco-Flex" insulation to provide stator coils impervious to moisture, highly resistant to abrasion, and thermally stable at high temperatures.

Liquid Level Gage Illuminator

743

Jerguson Gage & Valve Co., Burlington, Mass., has just released a data unit that illustrates and describes the new **Jerguson Liquid Level Gage Illuminator.**

The data sheet describes the illuminator as explosion-proof, solid wedge type that gives an evenly diffused illumination from a single medium base 58 watt bulb. The unit also has a simplified re-lamping procedure whereby a simple turn of one thumb screw allows removing the entire cover and glass housing in one piece.

Precision Pressure Meter

744

Fischer Porter Company, Hatboro, Pa., has just published a catalog on the **Press-I-Cell,** an instrument for the precise measurement of absolute, gage or differential fluid pressures.

The catalog describes the Press-I Cell as a device for measuring gases or liquids over pressure ranges from 0-4 psi to 0-1000 psi with a degree of accuracy as high as 1 part in 2000. Readability of the scale is of the order of 1 part in 8000.

As described by the catalog, the pressure-sensing mechanism of the Press-I-Cell consists of capsules or spirals which, when deflected by pressure, set an armature in motion within a set of differential coils. The electrical signal thus produced is sent to a servo motor which drives a 150 to 200 inch film scale to indicate the precise pressure value. Remote transmission is possible by photo pulse, digital, resistance or shaft outputs.

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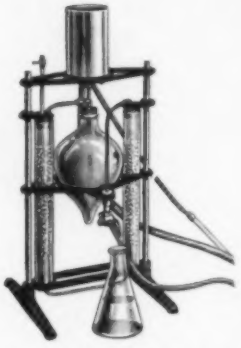

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Selecting Concrete Waterstops

745

Water Seals, Inc., Chicago, Ill., has issued a new catalog sheet of **Labyrinth Waterstops.**

Blueprint type specification drawings include the Labyrinth, Flextrip, Cellular and Dumbbell waterstops in their various sizes. A convenient table lists the recommended joint application and water head for each size and kind of waterstop.

According to the catalog sheet Labyrinth Waterstops are manufactured of the finest polyvinyl plastic yet developed and are resistant to age, chemical and weathering changes through the years. This durable material helps maintain a constant, strong, watertight bond between concrete joints. A convenient feature is that Labyrinth Waterstops can be cut and spliced into "L" and "T" joints with a hot knife in the field; prefabricated fittings are available, too.

Pressure-Rated Plastic Pipe

746

Crane Co., Chicago, Ill., has just published a booklet containing the latest technical information on **Pressure-Rated Plastic Pipe and Fittings.**

The 8-page booklet includes complete tables on pressure drop through plastic pipe, pressure-temperature rating for different sizes, and recommended pumping depths. Figures are given on Crane's three grades of polyethylene pipe: standard wall, 75-pound and 100-pound.

The new booklet includes pictures of plastic pipe installations, and explains installation procedure in words and pictures. There is also a page of information on companion polystyrene fittings: 90-degree elbows, and insert adapters, tees, couplings, and fitting clamps.

Proportioning Pumps and Diaphragm Valves

747

Hills-McCanna Company, Chicago, Ill., has just released a new 12-page 2-color catalog titled "Positive Flow Control" covering Hills-McCanna Proportioning **Pumps and Diaphragm Valves.**

This new catalog describes in detail the 4 basic models of precision proportioning pumps for use whenever there is a requirement for accurate and positive proportioning of flow in the range of 0-730 gph. The materials of construction, capacities and pressures are shown for each model.

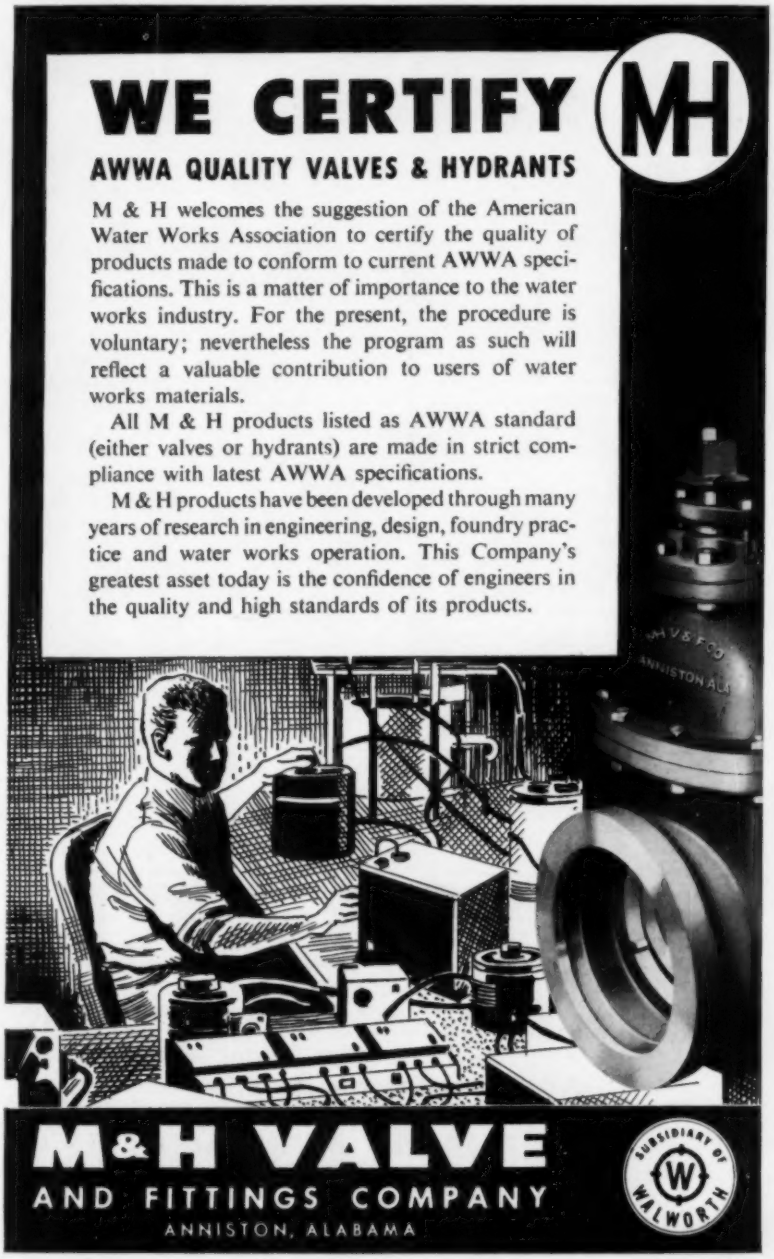
The line of Hills-McCanna Diaphragm Valves for positive closure are described and their exclusive features are pointed out. Of particular interest is the section on plastic valves and diaphragms, where plastic valves for temperatures up to 300°F are shown and the diaphragm material chart that provides a diaphragm selection for such diverse services as air, water, corrosive applications, slurries, liquids and gases.

Rotary Dryers For Sludge

748

Standard Steel Corp., Los Angeles, Calif. and Decatur, Ill. has released a new four-page bulletin describing the **Standard-Hersey Drying System** for treatment of sewage sludge and industrial waste.

The bulletin features eleven illustrations of the drying system including the rotary dryer itself. Integral parts are shown, such as the heavy duty pugmill, automatically controlled incinerator, discharge hood, bagging system and automatic control panel board.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Instruments and Controls

749

The Hays Corporation, Michigan City, Indiana, has just released a 12-page condensed catalog giving a digest of specifications of the complete line of **Instruments and Controls** manufactured by the company.

Contract Manufacturing of Process Equipment

750

Goslin-Birmingham Manufacturing Co., Inc., Birmingham, Ala., has available a folder giving a general description of the company facilities and services for the contract manufacture of **Process Equipment.**

The folder gives a brief description of the organization, facilities and personnel. Photos and descriptive text illustrate a number of the special jobs performed by the company, ranging from vacuum filters to gate valves and housings.

Sludge Collectors

751

Chain Belt Company, Milwaukee, Wis., has just released a bulletin giving the highlights of **Rex Conveyor Sludge Collectors.** The information is general in nature, and is intended to illustrate the diversity of the line of sanitation equipment offered by the company.

The bulletin covers three basic styles of conveyor sludge collectors—light, medium, and heavy duty. Equipment for special applications, basic components, and typical conveyor sludge collector installations are outlined and illustrated in the bulletin.

Application of Instrumentation To Sewage Treatment

752

Moore Products Co., Philadelphia, Pa., has just published a folder on the **Application of Moore Instrumentation to Sewage Treatment.**

The folder contains detailed information on the application of instrumentation to: screening; influent measurement; grit removal; grease removal; chemical treatment; and sedimentation. Secondary treatment is covered by information on: trickling filters; activated sludge; excess sludge control; digestion; and digestion control.

The folder also contains 11 engineering drawings illustrating the application of instrumentation to the various valves and meters of the sewage treatment plant.

Pneumatic Control Theory

753

The Bristol Company, Waterbury, Connecticut, has just published a new bulletin on **Pneumatic Control Instruments,** featuring more than ten pages of general automatic control theory.

The 44-page, two-color bulletin describes in simplified terms and illustrations the basic concepts of narrow band, proportional, reset, derivative, and reset plus derivative control actions. Also covered are selective control, cascade control, and ratio control.

Completing the bulletin are descriptions of the features of the company's line of Series 500 pneumatic recording and indicating controllers. Also included is complete information on sensing elements used with the instruments, for measuring and controlling such variables as temperature, pressure, humidity, flow, density and specific gravity, liquid level, and pH. Final control elements and accessories are listed.

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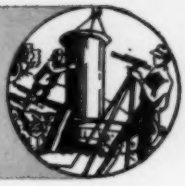

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1. Two years of college training, with major emphasis in chemistry or biological sciences, with three years of satisfactory experience in operation of sewage treatment works.
2. High school graduation and completion of a special course of training in sewage treatment with a minimum of five years satisfactory experience in the operation of sewage treatment works and demonstration of mechanical aptitude.
3. Satisfactory completion of a special course of training in sewage treatment with a minimum of six years satisfactory experience in the operation of sewage treatment works.

and sufficient prior training to be eligible for Wisconsin Grade "A" certificate within two (2) years.

Apply to Director of Public Works, City Hall, City of Superior, Wisconsin by letter stating education, experience and salary required.

Positions Available

SANITARY ENGINEERS—to work in Ohio on state public health programs. Previous Ohio residence not required.

Sanitary engineer, grade III—Graduation from accredited engineering college, preferably six years' experience, professional engineer registration from Ohio or reciprocal state required. Salary range $600-$720.

Sanitary engineer, grade II—Graduation from accredited engineering college, four years' engineering experience, professional engineer registration from Ohio or reciprocal state required. Salary range $525-$630.

Engineer-in-training— Graduation from accredited engineering college. Salary ranges $420-$480; $440-$525. Starting salary depends upon qualifications and experience in addition to having a certificate of engineer-in-training.

Address application to Personnel Officer, Ohio Department of Health, Columbus 15, Ohio.

INDEX TO ADVERTISERS

A

Albright & Friel, Inc. 129A
Alvord, Burdick & Howson 129A
*American Vitrified Products Co. 14A
*Anthracite Equipment Corp. 122A

B

Badger Meter Mfg. Co. 11A
Baffa, John J. 129A
Baker, Jr., Inc., Michael 129A
Betz Laboratories 129A
*B-I-F Industries, Inc. ..... Third Cover-27A
*Blackburn-Smith Mfg. Co. 120A
Black & Veatch 129A
Bogart & Childs 129A
Bowe, Albertson & Associates 129A
Boyle Engineering 129A
Buck, Seifert and Jost 129A
Buffalo Meter Co. 41A
*Builders-Providence, Inc. ..... Third Civer-27A
Burgess & Niple 129A
Burns & McDonnell 129A
Byers Company, A. M. 8A

C

Calgon Company 26A
Camp, Dresser & McKee 129A
Capitol Engineering Corporation 129A
Carborundum Company 20A
Cast Iron Pipe Research Ass'n 48A-49A
Centriline Corp. 114A
Chemical Equip Co. 128A
*Chain Belt Co. 25A
Chester Engineers, The 129A
*Chicago Bridge & Iron Co. 45A
*Chicago Pump Company 101A
Climax Engine Mfg. Co. 121A
*Clow & Sons, James B. 37A
*Columbia Southern Chemical Co. 12A
*Combustion Engineering, Inc. 24A
Consoer, Townsend & Associates 129A
Cotton, Pierce, Streander, Inc. 129A

D

Darling Valve & Mfg. Co. 21A
De Leuw, Cather & Company 129A
Dixie Tank & Bridge Co. 104A
*Dorr-Oliver, Inc. ..... Third Cover

E

Eddy Valve Co. 19A

F

Fairbanks-Morse & Co. 22A
Fay, Spofford & Thorndike, Inc. 129A
Finkbeiner, Pettis & Strout 129A
*Fischer & Porter Co. 17A
Ford Meter Box Co. 112A
Foxboro Co., The 47A
Freese, Nichols & Turner 130A

G

Gannett Fleming Corddry and Carpenter, Inc. 130A
Gilbert Associates, Inc. 130A
Glace & Glace 130A
*Graver Tank & Mfg. Co. 35A
*Graver Water Conditioning Co. 36A
Greeley & Hansen 130A

H

*Hardinge Company, Inc. 109A
Haskins, Riddle & Sharp 130A
Havens & Emerson 130A
Hayden, Harding & Buchanan, Inc. 130A
Hazen & Sawyer 130A
Healy-Ruff Company 122A
Hersey Manufacturing Company 15A
Henningson, Durham & Richardson 130A
Homelite Corp. 3A
Homestead Valve Mfg. Co. 23A
Hydraulic Development Corp. 128A

I

Industrial Chemical Sales 28A
*Infilco Inc. 29A

J

Jennings-Lawrence Co., The 130A
Jones, Henry & Williams 130A
*Johns-Mansville 30A

K

Keasbey & Mattison Company 32A
Kenan & Associates, R. L. 130A
Kennedy, Clyde C. 130A
Knowles, Inc., Morris 130A
*Komline-Sanderson Engr. Corp. 31A

L

Lanning Sanitary Engineering Co., Inc. 130A
Leupold & Stevens Instr. Inc. 111A
Leopold & Co., F. B. 126A
Lock Joint Pipe Company ..... Second Cover
Lockwood Greene Engineers, Inc. 130A
Lozier Co., Wm. S. 130A

M

*M & H Valve & Fittings Co. 127A
Metcalf & Eddy 130A
Minneapolis-Honeywell Reg. Co. 33A-42A
Mueller Company 38A-39A-103A

N

*Neptune Meter Company 52A
Nussbaumer, Clarke & Velzy, Inc. 130A

O

*Olin Mathieson Chem. Corp. 125A
Oliver Corp. 105A
*Omega Machine Co. ..... Third Cover-27A

P

*Pacific Flush Tank Company 13A
Parsons, Brickerhoff, Hall & MacDonald 130A
*Permutit Company 4A
*Phipps & Bird, Inc. 126A
Photovolt Corp. 124A
Pirnie Engineers, Malcolm 130A
Pitometer Associates, Inc., The 130A
Pittsburgh-Des Moines Steel Co. 9A
*Pratt Co., Henry 123A
*Pressure Concrete Co. 120A
Price Bros. Company 10A
Purcell, Lee T. 131A

R

Riddick, Thomas M. 131A
Robert and Company Associates 131A
*Roberts Filter Co. 122A
Royer Fdry. & Mach. Co. 102A

S

Sirrine Company, J. E. 131A
Smith & Associates, Benjamin L. 131A
*Smith, S. Morgan 43A
Standard Dry Wall Products Co. 119A
Stanley Engr. Co. 131A
Sparling Meter Co., Inc. 118A
Stilson & Associates, Alden E. 131A
Synchro-Start Products, Inc. 124A

T

*Tennessee Corporation 115A

U

Uhlman & Associates 131A
*U. S. Pipe & Foundry Co. 50A-51A
U. S. Rubber 34A-46A

V

Vulcan Materials Co. 113A

W

*Walker Process Equipment, Inc. 40A
*Wallace & Tiernan, Inc. ..... Back Cover
Wertz Engineering Co., Inc. 131A
Weston & Sampson 131A
Westinghouse Electric 6A-7A
Whitman & Howard 131A
Whitman, Requardt & Associates 131A
Wood Co., R. D. 116A-117A
Woodward Iron Co. 16A

Y

*Yeomans Bros. 18A

Z

Zimmer & Francescon 118A-126A

*Advertisers represented in the 1957 Reference and Data Number with Catalog specifications copy. Please refer to that issue for additional information concerning their products or equipment.

30 Tons of Mud a Day

removed to make the Mississippi potable!

B-I-F Case File
East St. Louis & Interurban Water Co.

Another Builders Auto-Central® filter backwash control system, installed by the East St. Louis and Interurban Water Company, is helping provide sufficient pure water to meet the needs of 250,000 people in homes, businesses, and industrial plants located in St. Clair and Madison Counties, Illinois. In 1956, an average of 46 million gallons per day of dark, bacteria-filled Mississippi River fluid was processed to crystal clear, potable water and delivered through 700 miles of pipelines to twenty cities, towns and villages in this area.

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To start the backwashing cycle, the operator simply presses the start button for a particular filter. This starts a sequencing of valves which drain the filter, apply backwash and surface wash flows in precisely regulated quantities, and then automatically return the filter to service when cycle is completed. Provision for manually controlling any or all these operations is also provided.

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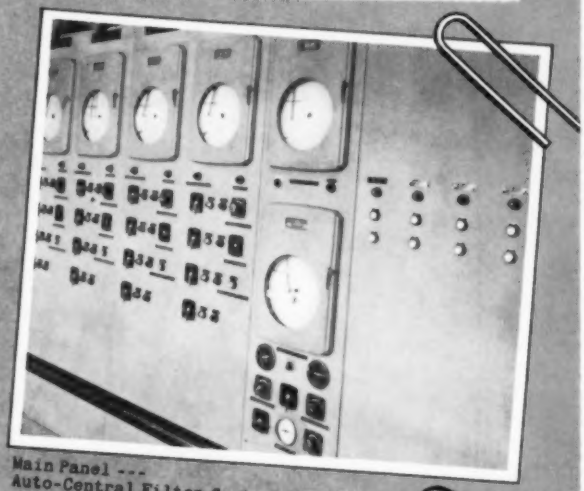
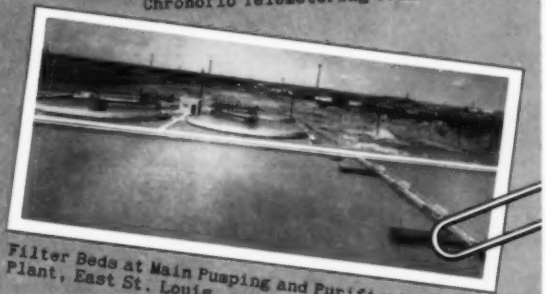


Main Panel ---
Auto-Central Filter Control

Chronoflo Telemetering Transmitters



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O. H. Brown, Chief Chemist, East St. Louis & Interurban Water Co. of American Water Works Service Co., Inc.

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